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The Commonwealth of Massachusetts.

FOURTH ANNUAL REPORT

OF THE

STATE BOARD OF LABOR AND INDUSTRIES.

JANUARY, 1917.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
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Publication of this Document
approved by the
Supervisor of Administration.

STATE BOARD OF LABOR AND INDUSTRIES.

ALFRED W. DONOVAN, *Chairman.*

JOHN F. TOBIN.	ALFRED H. QUESSY, M.D.
SAMUEL ROSS.	MRS. DAVIS R. DEWEY.

EDWIN MULREADY, *Commissioner of Labor.*

JOHN P. MEADE, *Deputy Commissioner of Labor.*

THOMAS F. HARRINGTON, M.D., *Deputy Commissioner of Labor (Medical).*

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The Commonwealth of Massachusetts.

REPORT OF THE STATE BOARD OF LABOR AND INDUSTRIES.

To the Honorable Senate and House of Representatives.

The State Board of Labor and Industries has the honor to submit herewith its fourth annual report.

The term of Mr. James A. Donovan as a member of this Board expired in March, 1916, and Mr. Samuel Ross of New Bedford was appointed to fill the position for a term of five years.

The Board held 44 meetings during the year, with an attendance of 90 per cent. of the members. Sixteen hearings and 25 conferences were also held, and 11 decisions were rendered.

Attention is called to the report of the Commissioner of Labor attached hereto and made a part of this report.

THE WESTERN UNION TELEGRAPH COMPANY.

Under date of June 1, 1916, the following order was adopted by the Massachusetts House of Representatives: —

> *Ordered*, That the State Board of Labor and Industries be required to inquire as to whether the recent discharge of telegraph operators by the Western Union Telegraph Company in the city of Boston was because of membership in the Commercial Telegraphers Union of America, an organization composed of commercial telegraphers in the employ of the various telegraph companies; and urge upon all parties at interest the necessity of taking such action as will prevent a strike, which would seriously handicap the commercial and industrial activities of the entire country.
>
> JAMES W. KIMBALL, *Clerk*.

The State Board of Labor and Industries, in accordance with this order, requested the telegraphers who were alleged to have been discharged by the Western Union Telegraph Company from their Boston office to appear before the Board for an investigation as to their contentions against the company, which was held on June 6, 1916, and they testified that from reasons assigned to them for their discharge there was no doubt that it was solely because of their membership in the Commercial Telegraphers Union of America. It was alleged that the company maintains secret agents, who, by misrepresentation and other questionable means, secure evidence that employees are members of the union and report to the company. One of the operators discharged testified that he was a supervisor, having charge of several telegraphers; that he had had his wages advanced shortly before his discharge, and was led to believe that he was a competent and satisfactory employee, and had been promoted several times since entering the employ of the company. When he was discharged he was questioned as to his sympathy with the other men who had been discharged, and he stated that naturally he was in sympathy with any person who loses his employment. In other instances the testimony was direct that the men were discharged because they were members in the above-named union.

Following this investigation Mr. John B. Rex, chief operator in the general office of the Western Union Telegraph Company in Boston, was requested to appear before the Board in connection with this investigation, as the testimony stated that Mr. Rex was the one who discharged the operators in question. Mr. Rex failed to appear, and Mr. Charles F. Ames, on June 9, 1916, appeared as a representative of the Western Union Telegraph Company, and stated that he had no knowledge as to the discharge of the men; that he had no information as to the policy of the company with relation to unions, and in answer to a question stated that Mr. Newcomb Carlton of New York, president of the Western Union Telegraph Company, was designated by the board of directors as executive officer for the company, and was the only one who could answer in regard to the matters referred to, but that as he was in the west he would not be able to appear before the Board until some time the following week, this information being communicated to Mr. Ames through the officials of the company in New York.

The Board then communicated with Mr. Newcomb Carlton of New York, president of the Western Union Telegraph Company, who promptly responded and appeared before the Board on June 16, 1916. The evidence of Mr. Carlton confirms the contention of the men that they were discharged because they were members of the Commercial Telegraphers Union of America, and that the supervisor referred to was discharged not only because of his sympathy with the other men who were discharged for similar cause, but that this man knew that he was discharged because of his membership in the union, and that he actually was a member. The further testimony of Mr. Carlton clearly and emphatically establishes the policy of the company as being opposed to the Commercial Telegraphers Union of America, and that any person known to be a member of that organization would be immediately discharged. Mr. Carlton, upon being asked as to whether he would deal with the employees of the company in their organized capacity under a union of any other name, replied that he would be glad to meet his employees either individually or collectively at any time, "but I will not deal with my employees through what is commonly known as a union organization." Mr. Carlton justifies the attitude of the Western Union Telegraph Company in their opposition to employees being organized into a labor union upon the ground that they must protect the public against the inconvenience of any interruption which would come from a strike, which would paralyze the business interests of the community.

Inasmuch as this Board is instructed by the order of the Legislature to ascertain what could be done to avert a strike in the telegraph industry, Mr. Carlton's attention was called to the fact that they were threatened with a strike notwithstanding his precautions against the existence of a union which might order a strike. To this Mr. Carlton replied that they were in no danger of a strike, that the public would not be inconvenienced in any way, and that he would suggest to the

Board that they test the accuracy of a possible strike by suggesting to Mr. Konenkamp of Chicago, general president of the Commercial Telegraphers Union of America, that he order a strike.

Before beginning this investigation this Board got in touch with Mr. Konenkamp, and secured his agreement that no strike should take place pending our investigation and report.

In reply to Mr. Carlton's suggestion that we test the danger of a strike by suggesting to Mr. Konenkamp that he order a strike, Mr. Konenkamp stated that the Commercial Telegraphers Union of America will not permit Mr. Carlton to suggest the time and place where a strike shall occur; and that while Mr. Carlton apparently has no regard for the convenience of the public, his employees, who are members of the Commercial Telegraphers Union of America, have a due regard for public welfare and respect the obligation which they have assumed to the State Board of Labor and Industries, which requested them to withhold any action pending its report.

The Board called Mr. Carlton's attention to a law of this Commonwealth, which provides that no employer, by himself or through others in authority, shall discriminate against any person because of membership in a labor union.

The stenographic report of the proceedings under this investigation is on file in the office of the Board.

The attitude of the company was such that it was decided to order the Commissioner of Labor to prosecute the Western Union Telegraph Company under the law. Application for a summons was made to the Boston Municipal Court, and, after several hearings, the court decided to deny our petition.

Establishment of Standards.

An important side of the work of the State Board of Labor and Industries is the establishment of standards which may meet with the approval of the employer and employee. In recognition of this fact the law provides that the Board may organize committees to investigate and recommend such standards.

During the past year the Board took up for consideration the preparation of "Safety Rules and Regulations and Machinery Standards," and were fortunate in the men who accepted an invitation to form a committee to consider these rules. The names of the committee are a guarantee that it will be well done and prove of great value to Massachusetts industries.

The following are the names of the committee: —

Prof. Edward F. Miller, Massachusetts Institute of Technology, Cambridge.
Mr. David S. Beyer, Massachusetts Employees Insurance Association, Boston.
Mr. J. L. Thompson, Travelers Insurance Company, Hartford, Conn.
William F. Garcelon, Esq., Boston, representing the Arkwright Club.
Mr. Robert S. Wallace, Fitchburg Yarn Company, Fitchburg, representing the Arkwright Club.
Mr. George H. Vose, United Shoe Machinery Company, Beverly.
Mr. Harry I. Thayer, New England Shoe and Leather Association, Boston.
Mr. Thomas F. Anderson, New England Shoe and Leather Association, Boston.
Mr. Alexander Makepeace, Richard Borden Manufacturing Company, Fall River, representing Fall River Cotton Manufacturers Association.
Mr. Henry G. Smith, Fore River Shipbuilding Corporation, Quincy.
Mr. Howard Coonley, Walworth Manufacturing Company, Boston.
Mr. William J. McGaffee, Thomas G. Plant Company, Boston.
Mr. Charles C. Benton, Associated Industries of Massachusetts, Boston.

Co-operation with Health Departments.

The work of the State Board of Labor and Industries touches at many angles the work of local and State health departments. The opportunity for team work in conserving both the health of the individual workers and the community health is very great. This opportunity has been developed to a great extent during the year, so that to-day there is the most active co-operation between these various departments and the State Board of Labor and Industries. A free exchange of reports of diseases and unsanitary conditions between the departments has been established, and any problem requiring the joint action of the health and labor departments has by this co-operation been attended to at once without friction or overlapping.

The State Board of Labor and Industries furnishes to the State Department of Health each month a detailed statement of all cases of occupational diseases having a bearing upon the community health; *e.g.*, anthrax, reported to the State Board of Labor and Industries, is also reported by this Board to the State Department of Health, in order that the community interests may be safeguarded from infection or contamination by the refuse from establishments where animal products infected with anthrax are being manufactured or handled.

PAWTUCKET FALLS BRIDGE, LOWELL.

In November, 1916, application was received from the contractor building the bridge over the Pawtucket Falls at Lowell asking for permission to work laborers and mechanics more than eight hours per day, alleging that the bridge was in a precarious condition and that he was unable to secure any substantial addition to the number of his workmen.

This presented two questions for the Board to consider: —

1. Is the bridge in such a condition that it will be permanently injured by unnecessary delay?

2. Is it possible to obtain a sufficient number of workmen to complete the bridge before cold weather arrives?

To consider the first question the services of Prof. Charles M. Spofford of the Massachusetts Institute of Technology were secured. To determine the second question Mr. Arthur M. Huddell, president of the Building Trades Council, was asked to investigate the matter. We have pleasure at this time in submitting the reports of these two gentlemen, and beg to say that upon the result of the reports the Board voted to grant the necessary permission.

Report of Mr. Spofford.

SUMMARY AND CONCLUSIONS.

1. At the present time the bridge is in a precarious condition owing to the possibility that it may be wrecked should the falsework be carried away by a flood.

2. So long as the arch rings are under construction the bridge will remain in a precarious condition; this condition will persist until these arches are finished, the concrete in them properly set, and the falsework can be removed.

3. Existing obstructions in the bed of the river, viz., the falsework of the new bridge, the foundations of the old bridge, and temporary heaps

of excavated material, should be removed before a severe flood occurs; otherwise damage to property may result.

4. There is little danger of loss of life occurring from damage to the bridge by floods, as these can usually be predicted twenty-four hours in advance.

5. It is probable that the contractor will be able to finish this bridge to a point where it will be self-supporting and the falsework can safely be removed before the occurrence of severe winter conditions; that is, on or before December 20. The precarious condition which will exist throughout this period makes it imperative for the contractor to work with the utmost speed.

REPORT IN DETAIL.

A statement of the condition of the bridge at the present time and the reasons for the above conclusions follow: —

1. Location and Description of Bridge.

The new bridge is located across the Merrimac River just below the Pawtucket Dam, and about one mile from the central district of the city. It is to replace an old iron structure, and is to consist of two sections, one across the canal and the other across the river proper. The first section is practically completed; the river section is partially completed, the remainder now being under construction. The principal members of the latter portion of the bridge are to be reinforced concrete barrel arches with clear spans, as follows, beginning with the Lowell end of the bridge: Span H, 117 feet, 6 inches; Span J, 117 feet, 6 inches; Span L, 60 feet.

2. Condition of the Work.

A personal inspection of the bridge was made on November 7 to determine the condition of the work at that date, and another on November 14 to determine the progress made during the elapsed interval. Information has also been obtained from the contractor and from the consulting engineer, Mr J. R. Worcester of Boston.

As a result of these observations and of the information thus received the existing conditions may be stated as follows: —

The new piers and abutments are completed, except for the wing walls at the Pawtucketville (northern) abutment, the locations of these walls not yet having been decided upon by the city. The old piers are still in place.

Some of the excavation of the river bed necessary to compensate for the increased obstruction of the river by the new bridge has been carried out, but the excavated material has been temporarily piled in the river bed, awaiting the completion of the arch rings, when it is to be used for filling on the new bridge. The contractor states that no other convenient storage space for this material is available.

The northerly span of the old iron bridge has been removed. The other is blocked up at its southerly end on an old pier and at its midstream end upon a pier of the new bridge.

The placing of the concrete in one-half of the bridge, *i.e.*, in a longitudinal strip half the width of the bridge and extending its entire length, is said to have been completed on October 30. This half of the structure would soon be self-sustaining had there not occurred a failure of the ledge foundation under the weight of a temporary pile bent near the northerly end of the central span, due to slipping of the ledge along a diagonal seam. The removal of this support threw a load on the green concrete which it could not carry, causing a dangerous crack, and necessitating the cutting away of the entire end of this portion of the arch ring, and its replacement by new concrete. This repair work was well under way on November 7, and was completed before November 14.

This accident was particularly unfortunate in view of the limited time available for the completion of the work, and the fact that until the crack was repaired the remaining half of the arch rings could not be poured. Moreover, until the new concrete used to repair the cracks is well set, the portion of the structure already constructed will not be self-supporting, and the falsework and forms under it cannot be removed without endangering the safety of the bridge.

The falsework required for the construction of the remaining half of the bridge, *i.e.*, the downstream half was well along towards completion on November 14. The condition of this part of the falsework at the time of each inspection may be described as follows: —

Span H. — November 7 Falsework about three-fourths completed and remainder being put in place.

November 14: Falsework completed and some of forms to support concrete arch in place.

Span J. — Span in which the accident occurred.

November 7: Falsework entirely completed.

November 14: Condition practically same as on November 7.

Span L. — November 7: Falsework not in place.

November 14: Falsework not in place.

3. Materials.

Considerable quantities of cement and steel are stored at the site, and I am informed by the contractor that he has all the necessary material except sand and stone, which is being delivered daily from near-by sources.

4. Time required to complete Arch Rings.

While it is impossible to predict with accuracy the time required to complete the pouring of the concrete of the arch rings, it would seem as if the following schedule might be carried out without serious difficulty if the work is properly conducted and expedited either by overtime work or by extra shifts, and if weather conditions remain reasonably favorable: —

November 20: Remainder of falsework installed, and pouring of arch rings in Span H completed.

November 24: Forms and steel reinforcement for remaining arch rings in position, and pouring of concrete in arch rings of Span L completed.

November 28: Pouring of concrete in arch rings of Span J completed.

December 1: Pouring of all other concrete resting on falsework completed. (Sidewalk brackets.)

December 20: Falsework removed.

January 1: Old piers in midstream removed and loose excavated material taken out of river bed.

This schedule is based upon the continuance of normal weather conditions. Long-continued storms would cause serious delays. Severe floods would destroy the falsework. Unusually cold weather would delay the construction materially. A discussion of some of these contingencies follows: —

5. *Temperature Conditions in November and December.*

The accompanying diagram[1] shows average maximum and average minimum temperatures in Boston during a period of forty-two years. The temperature in Lowell is said to average about 2° lower. It is evident from this diagram that protracted cold weather is not likely to occur during the period allotted for the pouring of the concrete. Even if it should occur, the placing of the concrete need not be delayed, provided proper precautions are taken to heat the materials and to cover the concrete when in place. In the period allotted to the setting of the concrete, the temperature is likely to be below freezing only for a portion of each day. The fact that the concrete itself generates heat while setting, that it is protected by wooden forms on the bottom and sides, and that it should be covered on top, would allow its setting to go on with reasonable continuity. After January 1 continuous cold weather is likely to occur, and serious delays may take place in the hardening of the concrete unless it is poured substantially in accordance with the schedule previously mentioned.

6. *Floods.*

A study has been made of the data upon river flow at Lowell, furnished by the Proprietors of Locks and Canals. These data cover the period from 1849 to date.

It is evident from this information that the chance of disastrous floods occurring during the period between November 15 and January 1 is not great. Such floods may occur, however, and it is impossible to predict when, or to tell just how severe, a flood will destroy the river falsework.

---

[1] Diagram on file at the office of the State Board of Labor and Industries.

7. *Stability of Structure.*

In accordance with usual custom the piers have not been designed of sufficient strength to carry the unbalanced thrust of a single span. Accordingly, the arch rings must be supported on falsework until any longitudinal strip under construction is entirely completed from end to end of the bridge and the concrete properly set.

At the present time the weak point in the bridge is the unhardened end of Span J which has been repaired, as previously mentioned. Until this is well set, and until the remainder of the arch rings are poured and set, a disastrous flood might result in the entire destruction of the new bridge, thereby choking the river bed and possibly causing serious damage to other property. This precarious condition will be eliminated as soon as the remainder of the arch rings are poured and set. Until that work has been completed the contractor should not only be permitted, but urged, in the interests of the public, to work at the greatest possible speed.

The obstruction to the river bed, due to the old pier now in place and to the loose excavated material, is considerable; and while the removal of this obstruction is less important than the completion of the arch rings, the contractor should work as rapidly as possible in removing these obstructions.

ACKNOWLEDGMENT.

The writer wishes to acknowledge the assistance he has received from Mr. Arthur T. Safford, assistant engineer in the Lowell office of the Proprietors of Locks and Canals, and to express his appreciation of the willingness of the contractor and the consulting engineer, Mr. J. R. Worcester, to give him all possible assistance in his examination of the work.

Respectfully submitted,

CHARLES M. SPOFFORD.

Report of Mr. Huddell.

To the State Board of Labor and Industries:

At the request of the Commissioner of Labor, Mr. Mulready, to investigate the condition at the Pawtucket bridge in Lowell, in reference to their request to work more than eight hours per day, as an emergency existed on the work, I was only too glad to comply with the request, and after visiting the works and talking with Superintendent Ramsay, the superintendent for the National Engineering Company, who are the contractors to build the bridge, and after investigating the labor conditions in the city of Lowell and the immediate vicinity, I beg leave to submit the following report: —

I find that there are three spans of this bridge that are uncompleted. It is of a reinforced concrete construction; two of the spans are 117½ feet long; the end span is 60 feet in length. The entire width of the spans are 60 feet, but one-half of the bridge has been completed its entire length, a width of 30 feet, leaving 30 feet in width to be completed. The end spans are to be completed first; the middle span must be the last one to finish, as the abutments will not permit the middle span to be built first. Under the middle span is what is known as the channel, where, if there was a heavy rain, or for any other cause the dam above the bridge was to overflow, the water would come down through this channel at a very rapid rate. This channel is more dangerous at the present time than under ordinary conditions, because of the large amount of rock from the old abutments and the ledge that have been temporarily placed there to be used as a fill later on on the top of the bridge, thereby making the channel narrower, which would increase the velocity of the water through this channel. I am reliably informed from my inquiries in Lowell that at this time of the year the dam overflows, and that this is the season that is very dangerous, as much damage is caused from freshets, heavy rainstorms or other reasons that would cause water to flow over this dam, and it is very much feared by the people in this vicinity.

I also find that the telephone and telegraph wires, electric light wires, and the feed wire of the Bay State Street Railway were attached to the old bridge and are to be laid in the new bridge, the telephone and telegraph wires to be laid under the sidewalk, the electric lights and Bay State wires to be laid under the roadway. These are now stretched across the Falls on telegraph poles, and a heavy sleet storm occurring would weigh these wires down, so that there would be great danger of the extra weight breaking the poles and possibly the wires, and in that way doing a large amount of damage.

I was informed by Superintendent Ramsay that the labor situation this summer has been something entirely unheard of as far as this work is concerned. It has been impossible for him to secure carpenters and laborers, although he has made every effort to do so. I verified this by visiting the different labor headquarters, and found that Mr. Ramsay had left a standing order at these headquarters for men to work on the bridge; that the pay of the laborers had been increased; that the pay of the carpenters is more in some instances than the customary and prevailing rate of wages that has been established by the carpenters in the city of Lowell; and that some carpenters now employed on the bridge are paid 10 cents more per hour than the wages in the city of Lowell. The superintendent on the job also informs me that he will employ, at any time that they can be secured, another crew of workmen. He has erected on this bridge two plants for concrete, and only one can be used, as he has only one crew of men, and as far as equipment is concerned this firm is equipped to operate a crew on each end of the bridge.

I find that when they start to pour concrete it is absolutely necessary that they should complete a section before the operation ceases, and this takes from thirteen to fourteen hours.

I also find that while the contract provides that the work should be finished on December 15, it also provides for an extension, or a clause allowing the company further time, provided proper emergencies have arisen during the construction of the work. The spring and summer were very wet, and a large amount of water was an obstruction to their work proceeding at its proper pace. The company are afraid of a large volume of water occurring at most any time and stopping their work, or tearing down the shores and braces, and if that condition occurred at this time of the year it would be almost impossible for them to again proceed before next spring. I am reliably informed that if this work of putting in the spans can be completed by the first of December they can feel secure, and the rest of the work, not being liable to interruption by the water, can proceed. The law provides that in cases of emergency, such as danger to life, property and public health, more than eight hours can be worked in any one calendar day. I find that such an emergency exists, as there is a danger to property if the water comes over the dam. I also find that there is liable to be danger to life if the workmen were employed on the bridge, and the shores and braces were swept away, and that the electric light wire and Bay State feed wire, if broken by a heavy sleet storm or a high wind, might also cause danger to life. And in conclusion I believe that the emergency specified in the law exists at the present time on this contract, and that an exemption should be given this firm under this condition, which the superintendent promises me will be complied with; namely, that if another crew of workmen can be secured they shall be employed on this work at once, either as an additional day crew or as a night shift.

Yours truly,

A. M. Huddell.

Legislative Recommendations.

The policy of the Board regarding legislation remains unchanged, and yet it was felt that certain changes in the law, a knowledge of which comes to us through our experience, might properly be suggested to the Legislature for the present year. Therefore we respectfully recommend the following legislation:[1] —

1. *Industrial Work in Tenements and Dwelling Houses.*

The law now provides for the inspection and licensing of places in which clothing is manufactured. It is very desirable that some check should be placed on the manufacture of goods in the home, and that the manufacture of other articles than those mentioned in the present law should be prohibited; also that articles of ornament, etc., which are to be attached to articles of clothing, should be included in the law; hence our suggestion.

---

[1] Bills covering these recommendations may be found in Appendix D.

2. Meal Hours of Women and Young Persons in Factories.

The continuous operation of machines in a textile establishment is sometimes accomplished by obliging the woman worker to operate two sets of machinery at the same time, thus taking advantage of the law which provides that this shall not be done except when the workers begin their work in different hours of the day. The court in which such a case has been tried has decided that five minutes or less in time of beginning work might mean a different hour. To accept this decision would be to nullify at least the spirit, if not the letter, of existing law, and in order to clear up any question in the mind of any court the proposed amendment is suggested.

3. Inspection Force.

Since the organization of this department it has been recognized that the inspection force was inadequate for the work which was entrusted to it. It is estimated that there are about 50,000 industrial establishments in the State, and but 24 inspectors to cover the work. In order that all the people of the State may receive the benefit of the present laws it is respectfully recommended that the law be changed so as to permit the appointment of six additional inspectors.

4. Receptacles for Expectoration.

One of the health dangers which is called to the attention of the Board is the provision regarding suitable receptacles for expectoration. The law relative to this matter divides the responsibility for unwholesome conditions, placing upon the State Board of Labor and Industries the duties of enforcing the law, but the approval of such receptacles by the local board of health. The law should be changed as suggested in the act herewith submitted, or the enforcement of the law should be left to the local authorities, which again would add to the division of responsibility.

5. Prohibited Employment of Minors.

The danger in the employment of boys in bowling alleys, so far as it relates to their school work, is as great in a private bowling alley as in one open to the public. In either case it is an employment which, in the opinion of this Board, should be forbidden to boys under sixteen years of age.

The employment of boys and girls as ushers and attendants in theatres and moving-picture houses has grown to large proportions, and we believe this should be forbidden.

Conclusion.

In presenting this report the State Board of Labor and Industries begs to express its full appreciation to those who have assisted by suggestion and advice in the work which it has undertaken for the State. There is every indication that employers and employees are getting nearer together, and that by their combined efforts there will come a day of still better conditions in the great industrial establishments of this Commonwealth.

Respectfully submitted,

STATE BOARD OF LABOR AND INDUSTRIES,

Alfred W. Donovan.
John F. Tobin.
Alfred H. Quessy, M.D.
Samuel Ross.
Mrs. Davis R. Dewey.

REPORT OF THE COMMISSIONER OF LABOR.

To the State Board of Labor and Industries.

In accordance with your instructions I have the honor to submit herewith my third annual report as Commissioner of Labor.

The year 1916 has been one filled with important events, and to our department has been brought many perplexing problems, the solution of which has taxed to the utmost the strength and value of the department organization.

This report, with the report of the Deputy Commissioner of Labor appended herewith, will, I am certain, convince the reader that the machinery of the Labor and Industries Department is designed to make many improvements in the conditions under which persons labor in this great industrial State, and while benefiting the employee work no injustice to the employer.

Enforcement of Labor Laws.

After another year's experience your attention is again called to the comparatively small number of cases in which prosecution has followed orders issued through this office. Employers have responded in a very co-operative spirit to our suggestions, and a large number of cases, where there seemed to be a misunderstanding, have been arranged by conference.

Inspections of more than 30,000 establishments, and reinspections exceeding 11,000 additional, with orders totaling more than 12,000, show at a glance a maximum amount of real active labor by our inspection force, reaching as it did all sorts of violations, and touching by direct contact the many persons whose temperaments were not always kindly disposed toward this particular State activity. The wonder is, therefore, that we were obliged to prosecute only 360 cases in order to bring about the desired result.

The following summary of the work of our Legal Department is submitted: —

Prosecutions,	360
Verdicts: —	
Guilty,	325
Not guilty,	30
Cases dismissed,	5
Total,	360

Character of offence: —	
Nonpayment of wages,	160
Overtime in industrial establishments,	18
Certificates not on file,	35
Time notice not posted,	22
Time other than stated on time notice,	19
Overtime employment on public works,	8
Failure to comply with rules and regulations *in re* painting business,	1
Strike on, not stated in advertisement,	16
Public exhibition of children under fifteen years of age,	1
Employing minors under sixteen years of age after 6 P.M.,	9
Employing minors under twenty-one years of age after 10 P.M.,	9
Employing minors under fourteen years of age in industrial establishments,	28
Employing minors under sixteen years of age in public bowling alley,	5
Employing women on machine other than their own during meal hour,	2
Parent permitting minor under fourteen years of age to be employed after 6 P.M.,	1
Prevailing rate of wage,	2
Not providing medical kit,	3
Employing minor on dangerous machinery,	1
Parent certifying to false statement,	1
Failing to designate toilet,	1
Not allowing twenty-four consecutive hours of rest,	1
Sunday schedule not posted,	2
Employing women more than ten hours a day,	1
Employing women more than fifty-four hours a week,	1
Improper toilet facilities,	1
Employing minors under sixteen years of age in assorting tobacco,	1
Employing minors under sixteen years of age over eight hours a day,	9
Parent permitting minor under fourteen years of age to be employed in a factory,	1
Failing to return certificate of minor,	1
Total prosecutions,	360

Wages paid to employee by employer after complaint,	$12,374 61

INSPECTION WORK.

During the year there were 30,617 inspections and 11,212 reinspections, making a total of 41,829 inspections for the year. There were 12,010 orders issued to correct conditions existing contrary to law at the time of inspection. Of these orders 10,475 were complied with, 175 were revoked because the concerns involved in the orders had gone out of business, and 3,284 were pending at the close of the year.

In addition to this regular routine inspection of places of employment, 189 cases of industrial disease and 3,028 complaints concerning working conditions were investigated. There were 2,398 homes visited for the purpose of deciding whether or not a license to do home work should be granted.

SUMMARY OF ORDERS ISSUED.

Hours of labor: —	
Minors,	409
Children under eighteen years of age, and women,	178
Minors under fourteen years of age,	27
Posting time notices,	1,829
Time notices for minors,	987
Sunday employment: —	
One day's rest in seven,	267
Work on Lord's day,	26
Sunday schedule,	264
Prohibited employment: —	
Minors under sixteen years of age near belts, etc.,	52
Minors under sixteen years of age on certain machines,	17
Minors under eighteen years of age on certain machines,	21
Certificates for minors: —	
Educational certificates,	1,655
Employment certificates,	477
Health, sanitation: —	
Toilets and washing facilities,	3,344
Ventilation,	323
Lighting,	9
Humidity,	10
Thermometers,	36
Drinking water,	94
Medical and surgical chest,	1,078
Dust removal,	93

Casters required,	10
Seats for women and minors,	66
Factory: —	
Dangerous machinery: —	
Guarding dangerous machinery,	567
Trap doors,	4
Injury to eyes,	2
Flying shuttle,	12
Traversing carriage,	1
Communication with power house,	70
Egress,	9
Weavers' specifications,	39
Written tickets for weavers,	31
Homework: —	
Licenses,	1
Total orders issued,	12,010

When we consider the large number of establishments still remaining without inspection because of the limited number engaged in the work, we are led to renew the suggestion contained in our last report that the greatest need is an increased force of inspectors, which we trust may be given us by early legislative action.

COMPLAINTS.

In addition to the work which comes to us in consequence of the visitation of our inspection force, the policy of the department has been to welcome legitimate complaints from the public, and it is our experience that many complaints of this kind constitute the foundation for our best inspection work.

There were 672 complaints received specifying that women and minors were being employed overtime, and 72 complaints that the eight-hour law was being violated.

It was reported further that 82 employers were not allowing the required one day of rest in seven.

Sixty complaints were received that minors were being employed without working certificates; 55 complaints that minors under fourteen years of age were being employed; and 90 general complaints against nonobservants of the law.

Twenty-two persons were complained against for advertising for help and not stating that labor trouble existed at the place of employment.

Complaint was received against 37 different establishments stating that no time notices were posted, and 27 public contractors were complained against because of the nonobservance of the law requiring that preference be given to citizens.

There were 1,586 cases of nonpayment of wages investigated and adjusted, while 6 complaints were received that the law on the prevailing rate of wages was not being observed.

In addition to these 2,599 complaints, the inspectors reported several instances of the nonobservance of many of the same laws as revealed by the routine inspection of establishments.

Employment and Educational Certificates.

While there has been some improvement in the administration of the certificate law, there is yet considerable room for authorities in many cities and towns to improve the facilities for issuing employment certificates. Every facility should be provided so that the child may be able to furnish to the employer the required certificate in accordance with the provisions of the law.

In many localities the system of delegating the certificating power to persons who can be readily reached has resulted either in the minor being employed illegally, *i.e.*, without a certificate, or losing the opportunity offered to secure work.

It has occurred several times during the year that school certificating authorities have issued employment certificates to minors for employment in occupations prohibited by statute to minors of specified ages.

There would also seem to be urgent need for educational guides and examining physicians, having the placing of minors in various industries, to become more familiar with the working conditions in these industries, in order that the child may not be sent into an industry or an occupation for which he is not fitted physically, and in which he is exposed to danger to health and life. The problem of shifting employment, dissatisfaction and failure, so often commented upon in dealing with the question of juvenile employment, would be greatly aided in its solution by giving more attention to these facts.

INDUSTRIAL SAFETY.

During the year 702 orders were issued to safeguard dangerous machinery and dangerous openings, to protect against eye injuries, to protect against flying shuttles and against traversing machinery.

Chapter 308 of the General Acts of the year 1916 was approved June 2, 1916, as follows: —

> The powers and duties of the state board of labor and industries and the industrial accident board, sitting jointly, in accordance with the provisions of chapter eight hundred and thirteen of the acts of the year nineteen hundred and thirteen, are hereby transferred to the state board of labor and industries.

By this act the power of making safety rules, formerly held by the Joint Board, is transferred to this department, and adds to the duties of our inspectors the investigation of accidents reported.

This duty has made it possible to pick many instances of unguarded machinery and other dangerous conditions at a much earlier date than would have been possible from routine inspection by our limited inspection force.

Each accident reported is investigated at once. The inspector goes to the place of the accident and furnishes to this office a detailed report of all conditions that might be evidence in the causation of the accident. If these conditions are remediable by statute an appropriate order is issued to the employer to install safety appliances calculated to prevent the recurrence of a similar accident.

This investigation includes an inspection of all other conditions, both sanitary and mechanical, at the establishment that have any bearing upon accident prevention.

This preventive work is now a well-established part of the duties of our inspection force. It is a genuine piece of accident prevention work, and promises the greatest returns in the reduction of industrial hazards to life and limb.

The "Safety Rules and Regulations and Machinery Standards," now being prepared by a special committee working with the Board, will be, when adopted, of great assistance in this feature of our department work.

HOTEL AND RESTAURANT INVESTIGATION.

By chapter 74 of the Resolves of 1916 the State Board of Labor and Industries received the following directions: —

> *Resolved*, That the state board of labor and industries is hereby authorized and directed to investigate the hours and conditions of labor prevailing in hotels and restaurants throughout the commonwealth, and particularly to inquire into and consider the questions involved in certain petitions presented to the general court during the current year, with accompanying bills known as house bills, numbers one hundred and thirty-eight and thirteen hundred and seventy-six, providing that employees of hotels and restaurants shall be granted one day's rest in every seven days, and to report the results of its investigation, with recommendations for such new legislation as may seem expedient, to the next general court not later than the tenth day of January.

Acting under your instructions this investigation was conducted by a corps of investigators, and the following report prepared for the Legislature: —

To the Honorable Senate and House of Representatives.

Complying with the requirements of chapter 74 of the Resolves for the year 1916, the State Board of Labor and Industries herewith respectfully presents its report on the investigation, conducted under its direction, of the labor conditions prevailing in the hotel and restaurant business of the Commonwealth, together with recommendations for legislation designed to improve such conditions, and with particular reference to the application of the so-called "one day's rest in seven" law to these establishments.

If this investigation succeeds in throwing light upon the problems of hotel life it is largely due to the fact that from the beginning we have had the most cordial co-operation from the officials of the Hotel Men's Association and those representing the hotel employees. Through the efforts of the association a large number of hotel managers voluntarily furnished complete reports showing in detail the condition of their individual establishments; the unions, representing the employees, were very helpful by suggestion and otherwise in furthering the objects of the inquiry, and at the beginning we desire to express our appreciation of the great help obtained from these agencies.

Establishments Visited.

In the course of the investigation public hearings were held in different localities, and 218 establishments were visited which were classified as follows: —

Employing less than 15 persons,	73
Employing 15 to 25 persons,	56
Employing 25 to 50 persons,	27
Employing 50 to 100 persons,	40
Employing over 100 persons,	22

The Hotel Men's Association suggested the names of certain of their members, the unions doing the same, and from these lists the investigators were selected. Each place was visited by both investigators at the same time, and the report on conditions was signed jointly by the visitors. Other investigators were appointed who secured positions as chambermaids, waitresses, etc., whose reports, made from the viewpoint of the employee, served as a check on other reports received from other sources.

Location.

The cities and towns visited by our investigators were as follows: —

Adams.
Boston.
Bridgewater.
Brookline.
Cambridge.
Charlestown.
Cheshire.
Chester.
Clinton.
Fall River.
Falmouth.
Fitchburg.
Gloucester.
Great Barrington.
Greenfield.
Green Harbor.
Harwichport.
Haverhill.
Holyoke.
Hull.
Hyannis.
Lawrence.
Leominster.
Lenox.
Lowell.
Magnolia.
Manchester-by-the-Sea.
Nantasket Beach.
New Bedford.
North Adams.
Northampton.
North Falmouth.
Osterville.
Palmer.
Pittsfield.
Plymouth.
Provincetown.
Revere Beach.
Rockport.
Salem.
Scituate.
Springfield.
Stockbridge.
Taunton.
Westfield.
West Yarmouth.
Williamstown.
Winthrop.
Worcester.

There are few classes of business which are more clearly classified than the hotel business. We have the American plan, the European plan and the so-called family hotel. There is also a class of hotels which might be more properly called "saloons" with hotel licenses attached. These establishments make more difficult the task of running a legitimate house.

CONSTRUCTION.

Early in this investigation it was found that some at least of the alleged evils were beyond the power of the managers of the hotels to correct because of the fact of faults in the construction of the building. As an instance we found that in 40 per cent. of the hotels visited the kitchen was in the basement or sub-basement, which it is almost impossible to properly ventilate. As one hotel man said, "It seems as though hotels were designed so that the guests' apartments should contain everything for the comfort of the occupants; the dining rooms must be attractive; the office must be in a pleasant part of the building; and when all these important parts of the hotel are accommodated, if there is a part of the building undesirable for any other use the kitchen is placed in that portion of the building." This condition is not only unfortunate from the standpoint of those obliged to work in such a place, but it is a fact that food prepared under these conditions is not as wholesome as if the same food was prepared under different conditions.

This evil could be corrected by a provision of law which would call for the approval of hotel plans by some central authority, which would have in view the evils which come from improper construction of such buildings.

LODGING.

Hotels have been described as "homes" for the accommodation of the public. They are also in many instances the only home of those obliged to labor in hotels; hence the importance of considering living conditions in the hotel, not only for the guests, but for the employees as well.

In order that we may appreciate the standards which were established in this work it may be well to define the different classes according to conditions as we found them.

Employees' lodging conditions defined as *good* are in the annex; two in a room; bath and toilet on the same floor; sufficient light and air. The rooms are clean and comfortably furnished with single cots, bureau, small table and chairs. The toilet room and bathroom are clean and disinfected regularly; sufficient bedding and towels. Rooms cared for by occupants.

Employees' lodging conditions defined as *fair* are on the seventh floor; small rooms, clean and well furnished, but with no heat in winter and with insufficient air and light due to a sloping roof and small skylight. Toilet on the same floor is clean. The bathroom is in an adjoining wing, which necessitates going out of doors.

Employees' lodging conditions defined as *poor* are in the annex; three in a room, with a single and a double bed; toilet and bath on the same floor in very bad condition, in need of painting and disinfecting. The bathtub is unfit for use, so that the girls are obliged to carry water to their rooms for bathing. Many bedbugs. Insufficient bedding and towels.

Another lodging described as *poor* is a large room containing four double beds with eight occupants, having but one window. A number of hotels had lodgings for their employees in the basement.

Employees' lodgings in 36 per cent. of the hotels in question are rated as good; 49 per cent. as fair; and 15 per cent. as poor.

From the report of the hotel managers we find that the estimated value of the room occupied by employees ranges from $2 per week to $10 per month for each person. In one case where $2 per week per person was the estimate the room was occupied by four persons in two double beds. From 80 cents per week to $2 per month, in addition to regular wages, is the amount generally allowed an employee who rooms outside the hotel.

Meals.

Where large numbers of persons are employed during the day, including ordinary meal times, there is an obligation on the part of the employer to make such arrangements as will insure a proper food supply, good in quality and adequate in quantity.

A hotel is a great industrial establishment, employing in many instances hundreds of persons, and no hotel management can be considered complete which does not provide an efficient commissary department for its own employees, thus not only making more satisfactory the life of the worker, but also tending to more efficient service on the part of those employed. We find that this has not received the attention that it should.

Many complaints were received about the food furnished to employees, — complaints covering the quality, quantity, preparation and service. The investigation led to a classification of the meals furnished, and we have designated such meals as poor, fair and good.

A meal described as *poor* consists of soup made of all sorts of left-over food, salt meat often spoiled, potatoes, bread and tea. A dish of each kind of food is placed at one end of each long table seating about 20 persons. Each one must go to the end of the table and help himself. There is never enough for a second helping, and any one coming late is apt to go without food. No butter or dessert is ever served. The dining room is on the third floor and is dark and dirty. The legs of the table are placed in dishes of water to keep ants from getting on the table and food. This method, however, is not entirely successful. Fifteen or twenty minutes is the usual amount of time spent for each meal.

A meal characterized as *fair* consists of boiled potatoes, fish, stewed tomatoes, milk or tea, bread and butter and bread pudding. The food is poorly prepared, the potatoes are boiled without washing, the fish is not thoroughly cooked, the tomatoes not heated through and the pudding pasty. This was served in the help's dining room in the basement, which is clean and well ventilated. There is one long table which seats about 25 persons, and they are served by one woman.

A meal reported as very *good* consists of well-cooked meat, vegetables and dessert; also good coffee or tea, bread and butter, such as served to the guests, with few or no restrictions. This food is served in the main dining room for the dining-room help, they waiting upon themselves. The kitchen help and chambermaids eat at a table in a corner of the kitchen. The table and set-up are clean and not crowded. The food is served individually and well cooked.

Another report of *good* service is one where a large working force is employed. There are a number of small tables accommodating four or five persons, with a system of self-service.

From the reports received, the meals as classified are in equal proportion, — good, fair and poor. As a rule, the best meals are served in the smallest hotels. From the statement of the employers the cost of meals furnished the employees varies from $3 to $6.25 for kitchen help, chambermaids, waitresses, etc., and $10.50 to $17.50 for heads of departments. Our reports show that in case the employee prefers to take his meals outside the hotel only $2.25 per week to $10 per month is allowed.

WORKING CONDITIONS.

While it is not the purpose of this report to include in its scope those conditions which tend toward immorality, it is difficult to describe the conditions under which many employees are obliged to work without speaking of conditions which are the unavoidable result of the immoral character of those places.

While we are well aware that the law obliges the landlord to entertain his guests, there is no law which would oblige him to receive intoxicated or partly intoxicated people, thereby increasing not only the amount of labor to be performed but also entirely changing the character of the work.

For instance, we find places where, the rooms being rented several times in one night, the work of the chambermaid is not only extremely difficult but disgusting, taxing her strength and ability to the maximum.

The conditions we are now describing are not found in the majority of hotels, but there are sufficient places where they exist to make it necessary to state them in this report.

WAGES.

In this investigation the question of wages, while a very important part of the hotel situation, has not received the attention it deserves, partly because of the lack of time, and also because we were advised that another State department[1] was preparing a very extensive report on that question.

In considering the matter of wages, however, it is well to bear in mind that unlike most other industries the employees are obliged to deduct from their wages a considerable portion, which is used in various ways in connection with the conduct of the hotel business. For instance, bell boys, porters and waiters pay for the use of their uniforms a sum varying from 50 cents to $4 per month. In some places the waitresses are obliged to contribute from their wages a certain percentage to pay for the service of "bus boys," all of these deductions making quite an item when taken from persons whose average wage is very low.

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[1] Minimum Wage Commission.

This question of wages is introduced at this time, for it has much to do with the hours of labor. If a party is being served in a hotel or restaurant, and desires for any reason to stay over the ordinary time in which the waitress closes her work for the day, the girl is obliged to stay, — perhaps is willing to stay because of the expected tip which would come from such a party. Her wages, therefore, depend on the size of the tip, which is of no certain quantity, if, indeed, there is any certainty of her getting the tip at all.

The "tip" system and its attendant evils are responsible for a large percentage of the discontent which may be observed in hotel workers; not so much because of the system of tips, but because of the anxieties and uncertainties of the situation created by voluntary offerings from patrons in the places in which they serve.

Hours of Labor.

Relative to the part of the inquiry which concerns the number of establishments observing the "one day's rest in seven" law, it becomes important to consider the hours of labor of employees in hotels as conducted at the present time.

Our investigation would seem to show that in the smaller hotels the employees work longer hours than in the larger places. That is accounted for by the fact that it is easier to have a proper organization where a large force is employed.

The following table will show the result of our investigation on this point: —

Under Fifteen Employees.

Kitchen Men.

5 work 60 hours or under per week.
4 work 60 to 70 hours per week.
4 work 75 to 85 hours per week.
1 works over 100 hours per week.
Maximum, 14½ hours per day.

Kitchen Women.

8 work 54 hours or under per week.
13 work 55 to 65 hours per week.
5 work 70 to 80 hours per week.
4 work over 80 hours per week.
Maximum, 16 hours per day.

Waitresses.

13 work 54 hours or under per week.
5 work 55 to 65 hours per week.
2 work over 70 hours per week.
Maximum, 12 hours per day.

Waiters.

5 work 50 to 60 hours per week.
2 work 60 to 70 hours per week.
3 work 70 hours or over per week.
Maximum, 13 hours per day.

Bartenders.

24 work 50 to 60 hours per week.
7 work 60 to 63 hours per week.
1 works over 63 hours per week.
Maximum, 10 hours per day.

Scrub Women.

2 work 7 hours a day.

Bellboys.

6 work under 60 hours per week.
2 work over 60 hours per week.
Maximum, 12 hours per day.

Chambermaids.

25 work 54 hours or under per week.
3 work over 54 hours per week.
Maximum, 12 hours per day.

Clerks.

4 work under 60 hours per week.
10 work 60 to 70 hours per week.
5 work 80 to 90 hours per week.
Maximum, 13 hours a day.

Porters.

5 work under 60 hours per week.
8 work 60 to 70 hours per week.
2 work over 70 hours per week.
Maximum, 11 hours per day.

Laundry Help.

2 work 54 to 60 hours per week.
3 work over 60 hours per week.
Maximum, 12 hours per day.

Fifteen to Twenty-five Employees.

Kitchen Women.

3 work under 54 hours per week.
10 work 55 to 70 hours per week.
8 work 70 to 80 hours per week.
2 work over 80 hours per week.
Maximum, 13 hours per day.

Waitresses.

12 work under 54 hours per week.
2 work 54 to 60 hours per week.
2 work 60 to 70 hours per week.
1 works over 70 hours per week.
Maximum, 13 hours per day.

Bartenders.

5 work under 60 hours per week.
7 work 60 to 70 hours per week.
Maximum, 17 hours per day.

Laundresses.

2 work under 54 hours per week.
1 works 60 to 70 hours per week.
3 work over 70 hours per week.
Maximum, 12 hours per day.

Kitchen Men.

3 work 50 to 60 hours per week.
4 work 70 to 80 hours per week.
4 work 80 to 90 hours per week.
Maximum, 12 hours per day.

Waiters.

6 work 60 to 70 hours per week.
1 works over 70 hours per week.
Maximum, 16 hours per day.

Chambermaids.

16 work under 54 hours per week.
5 work 54 to 60 hours per week.
Maximum, 9½ hours per day.

Clerks.

3 work under 60 hours per week.
6 work 60 to 70 hours per week.
6 work 70 to 80 hours per week.
4 work over 80 hours per week.
Maximum, 13 hours per day.

Bellboys.

3 work 56 hours or under per week.
7 work 60 to 70 hours per week.
3 work over 70 hours per week.
Maximum, 14 hours per day.

Porters.

3 work under 60 hours per week.
5 work 60 to 70 hours per week.
4 work 70 to 80 hours per week.
7 work over 80 hours per week.
Maximum, 12½ hours per day.

Twenty-five to Fifty Employees.

Kitchen Men.

6 work 55 to 65 hours per week.
10 work 70 to 80 hours per week.
6 work over 80 hours per week.
Maximum, 13½ hours per day.

Kitchen Women.

5 work 54 hours or under per week.
5 work 55 to 70 hours per week.
7 work over 70 hours per week.
Maximum, 10¼ hours per day.

Bartenders.

1 works under 50 hours per week.
6 work 50 to 60 hours per week.
2 work over 60 hours per week.
Maximum, 10 hours per day.

Porters.

4 work 50 to 60 hours per week.
6 work 60 to 70 hours per week.
5 work 70 to 80 hours per week.
Maximum, 11 hours per day.

Cashiers, Clerks.

1 works under 54 hours per week.
12 work 55 to 65 hours per week.
2 work over 70 hours per week.
Maximum. 12 hours per day.

Bellboys.

7 work 60 hours or under per week.
6 work 60 to 70 hours per week.
3 work over 70 hours per week.
Maximum, 12 hours per day.

Waitresses.

11 work 54 hours or under per week.
4 work 54 to 65 hours per week.
2 work over 70 hours per week.
Maximum, 12 hours per day.

Waiters.

4 work 50 hours or under per week.
5 work 60 to 70 hours per week.
3 work over 70 hours per week.
Maximum, 12¾ hours per day.

Chambermaids.

12 work 54 hours or under per week.
3 work over 54 hours per week.
Maximum, 12 hours per day.

Checkers, Operators, Stenographers.

4 work 54 hours or under per week.
2 work over 54 hours per week.
Maximum, 8 hours per day.

Cleaners.

5 work 54 hours or under per week.
2 work over 54 hours per week.
Maximum, 10 hours per day.

Engineers.

2 work 60 to 70 hours per week.
6 work over 70 hours per week.
Maximum, 12 hours per day.

Fifty to One Hundred Employees.

Kitchen Men.

3 work under 60 hours per week.
4 work 60 to 70 hours per week.
4 work over 70 hours per week.
Maximum, 12 hours per day.

Kitchen Women.

6 work under 54 hours per week.
9 work 55 to 65 hours per week.
2 work over 65 hours per week.
Maximum, 13½ hours per day.

Bus Boys.

5 work under 54 hours per week.
2 work over 75 hours per week.
Maximum, 11 hours per day.

Chambermaids.

17 work 54 hours or under per week.
3 work over 60 hours per week.
Maximum, 12½ hours per day.

Housemen.

3 work 55 to 65 hours per week.
2 work 70 to 75 hours per week.
Maximum, 11 hours per day.

Laundry Help.

5 work under 54 hours per week.
2 work over 54 hours per week.
Maximum, 8 hours per day.

Clerks.

4 work under 54 hours per week.
6 work 60 to 70 hours per week.
3 work 70 to 80 hours per week.
3 work over 80 hours per week.
Maximum, 12 hours per day.

Porters.

4 work 55 to 65 hours per week.
2 work over 70 hours per week.
Maximum, 12 hours per day.

Waitresses.

12 work 54 hours or under per week.
2 work over 54 hours per week.
Maximum, 9 hours per day.

Waiters.

2 work 54 hours or under per week.
4 work 60 to 70 hours per week.
3 work 70 to 80 hours per week.
3 work over 80 hours per week.
Maximum, 15 hours per day.

Bartenders.

2 work 50 to 60 hours per week.
2 work 60 to 65 hours per week.
1 works over 65 hours per week.
Maximum, 9½ hours per day.

Linen Girls.

1 works 65 hours per week.
1 works over 100 hours per week.
Maximum, 19 hours per day.

Scrub Women.

1 works under 54 hours per week.
1 works over 54 hours per week.
Maximum, 9 hours per day.

Bell Boys.

1 works under 50 hours per week.
5 work 50 to 60 hours per week.
10 work over 60 hours per week.
Maximum, 12 hours per day.

Female Office Help.

3 work under 54 hours per week.
2 work over 55 hours per week.
Maximum, 8½ hours per day.

Telephone Operators.

3 work 45 to 54 hours per week.
1 works over 54 hours per week.
Maximum, 8½ hours per day.

Watchmen.

3 work 70 to 80 hours per week.
1 works 60 to 70 hours per week.
Maximum, 11 hours per day.

Firemen, Engineers.

2 work 60 to 70 hours per week.
1 works over 70 hours per week.
Maximum, 12 hours per day.

Over One Hundred Employees.

Kitchen Men.

8 work 50 to 60 hours per week.
7 work 60 to 70 hours per week.
9 work over 70 hours per week.
Maximum, 12½ hours per day.

Waiters.

5 work 60 hours or under per week.
6 work 60 to 70 hours per week.
5 work over 70 hours per week.
Maximum, 11 hours per day.

Bus Boys.

2 work 55 to 65 hours per week.
3 work 65 to 70 hours per week.
Maximum, 10 hours per day.

Chambermaids.

17 work 54 hours or under per week.
6 work 55 to 70 hours per week.
3 work over 70 hours per week.
Maximum, 12 hours per day.

Housemen.

4 work 50 to 60 hours per week.
4 work over 60 hours per week.
Maximum, 10½ hours per day.

Clerks.

2 work 54 hours or under per week.
11 work 55 to 65 hours per week.
2 work over 70 hours per week.
Maximum, 12 hours per day.

Bell Boys.

1 works under 54 hours per week.
13 work over 60 hours per week.
Maximum, 12 hours per day.

Watchmen.

2 work under 60 hours per week.
5 work 60 to 70 hours per week.
Maximum, 10 hours per day.

Kitchen Women.

8 work under 54 hours per week.
5 work over 60 hours per week.
Maximum, 10 hours per day.

Waitresses.

3 work under 54 hours per week.
1 works over 60 hours per week.
Maximum, 10½ hours per day.

Bartenders.

2 work under 50 hours per week.
6 work 50 to 60 hours per week.
7 work 60 to 70 hours per week.
Maximum, 11 hours per day.

Scrub Women.

5 work 54 hours per week.
1 works over 54 hours per week.
Maximum, 8 hours per day.

Laundry Help.

8 work 54 hours per week.
2 work over 60 hours per week.
Maximum, 9½ hours per day.

Female Office Help.

8 work under 54 hours per week.
6 work 55 to 65 hours per week.
Maximum, 11 hours per day.

Porters.

1 works under 60 hours per week.
9 work 60 to 70 hours per week.
1 works over 80 hours per week.
Maximum, 12 hours per day.

Firemen, Engineers.

4 work under 60 hours per week.
3 work 70 to 80 hours per week.
Maximum, 12 hours per day.

An analysis of these figures would seem to indicate that some change must be made in the hours of labor of those employed in hotels. It would also seem to justify the demand on the part of the hotel workers for "one day's rest in seven," for in nearly all industries where this principle has been adopted, so far as we are advised, it has proven an efficient method of doing business.

One Day's Rest in Seven.

In 1913 the Legislature, recognizing the principle that no human being should be obliged to work all the time, provided a law that "every employer of labor, whether a person, partnership or corporation, engaged in carrying on any manufacturing or mercantile establishment, shall allow every person, except those specified, employed in such manufacturing and mercantile establishment, at least twenty-four consecutive hours of rest in every seven consecutive days." Among the exemptions under this law were hotels and restaurants.

Several suggestions have been made to amend this law so that hotels and restaurants should be included, but it has been urged that on account of the nature of the hotel business such a change would place a burden upon hotel managers which would be unbearable.

This contention is hardly borne out by our investigation, for we find that without the necessity of a law certain hotels have voluntarily adopted the principle contained in the law, and the employees of such establishments are favored with the "one day's rest in seven."

The following table, classified in accordance with the occupation of each, and the number of employees in each establishment, shows the number reported as giving "one day's rest in seven:" —

Under Fifteen Employees.

Class of Employees.	Number of Hotels.	Class of Employees.	Number of Hotels.
Bartenders,	3	Waitresses,	1
Waiters,	2	Night Clerks,	1

Fifteen to Twenty-five Employees.

Class of Employees.	Number of Hotels.	Class of Employees.	Number of Hotels.
Bookkeepers,	1	Porters,	1
Bartenders,	4	Waiters,	2
Clerks,	1	Waitresses,	2
Kitchen help,	1		

Twenty-five to Fifty Employees.

Class of Employees.	Number of Hotels.	Class of Employees.	Number of Hotels.
All kitchen help,	1	Bartenders,	4
Counter and pantry girls,	2	Porters,	2
Waiters,	4	Bell boys,	1
Waitresses,	4	Stenographers,	1

Fifty to One Hundred Employees.

Class of Employees.	Number of Hotels.	Class of Employees.	Number of Hotels.
All employees,	1	Kitchen help,	2
Bookkeepers,	2	Waitresses,	1
Bartenders,	2	Waiters,	3
Bus boys,	2	Laundry help,	2
Clerks,	2	Porters,	3
Linen room girls,	1		

Over One Hundred Employees.

Class of Employees.	Number of Hotels.	Class of Employees.	Number of Hotels.
Bartenders,	2	Housemen,	1
Cashiers,	1	Private office help,	1
Chambermaids,	3	Waiters,	5
Cooks,	3	Waitresses,	5
Kitchen help,	3	Porters,	3
Telephone operators,	1	Laundry help,	2
Head engineer,	1	Watchmen,	1

A number of hotel managers have testified to the effectiveness of this system of treating their help. One manager has said "that while there seems to be a slight increase in the cost of additional help, which was made necessary by this change in his house, the expense was more than compensated by the increased efficiency of the help and the advantage of having one or two additional men in cases of emergency." The hotel to which we refer has an average of 90 employees, every one of whom receives twenty-four consecutive hours of rest in every seven consecutive days.

Summer Hotels.

Massachusetts has within a few years attracted to its mountain and seashore a large number of people from all over the world. At first many of these people were accommodated in the homes of the permanent residents of seaside and mountain. After a time these homes gave way, to some extent, to large and very commodious and modernized hotels, these establishments being designated as summer hotels, many of them remaining open for six months, while others have more recently combined not only the pleasure of a summer resort but that of a winter resort as well.

Our attention has been called to these places as deserving of special consideration, and some have gone so far as to propose that they be exempt from rules and regulations governing other classes of hotels.

Forty-one of these establishments have been investigated, and as a result we have reached the conclusion that while some of the problems presented by the summer hotels are different than the ordinary city hotels, it may be said that the difference in the problem increases the burden of those employed in summer hotels.

While the difficulties of the employment situation in country places far removed from large centers are perplexing, many of those who finally enter the employment of these establishments are obliged to work under more unsuitable conditions than are those employed in the regular hotel business. Nearly the entire season of these places is a "rush" season, and work is often crowded on those employees in a way which was never contemplated by those who provided suitable working hours for women and minors. Many of the employees are students of schools or colleges who are obliged by force of circumstances to work at a time when other students rest.

These employees cannot be granted privileges which are denied other workers for the reason that with the class herein described are many who work continuously, returning to the city hotel at the close of the summer season, and to discriminate because of the large number of students or other temporary help would be to deprive the former class mentioned of rights which we have asserted belong to every human being.

Not the least of the evils of this situation is the "contract" system under which they work, which obliges them in some instances to forfeit nearly all they earn during the summer if, at the end of the season, the employer is prepared to say that their work is not satisfactory; and in some instances where they are obliged to leave before the close of the season they are taxed by the hotel management for the expense of filling their places.

It is claimed that the pressure of business in the middle of the season is more than made up by the very quiet time which is experienced at the opening and closing of a season, but the fact remains that human beings are tired by the day and not by the week, the month or the season; hence those people need the protection which by law is given to other workers.

So far as the food and lodgings and other sanitary conditions are concerned, there is but slight difference between the summer hotels and other hotels, the difference, if any, being in favor of the city as against summer hotels.

Restaurants.

While restaurants were included in the scope of this inquiry and while we have visited a large number, we do not find the necessity for reporting upon this feature of our work in detail as we have endeavored to do in the hotel situation.

We have investigated a large number of restaurants, and these establishments are found to be easily classified: counter lunch, department store lunch, tea room, business men's lunch, dairy lunch, and the ordinary first-class restaurant.

On the whole, the food furnished to employees in restaurants has been found better than that furnished to hotel employees. On the other hand, a "fine" system has been introduced into restaurants, which is a great burden on the employees. The imposition of a fine, without in some instances very much consideration, is always an evil, and when employees are employed in a business during "rush" hours, and are obliged to *rush*, it seems unfair to impose a fine for unavoidable mistakes and accidents.

In addition to this system employees are obliged to wear uniforms, the cost of which is taken from their wages, and in some instances sold to them by their employers at exorbitant prices.

Many conditions similar to those found in hotels were noted in connection with the work of restaurants. No valid argument has been advanced to show a reason for exempting restaurants from the "one day's rest in seven" law.

Conclusion.

In the investigation which has been made, the State Board of Labor and Industries has had in mind a full appreciation of the fact that millions of capital are invested in the hotel business in this Commonwealth. Many of the employees in this business are in closer personal touch with the elements which make for success or failure than in almost any business that can be mentioned. We have, therefore, attempted to avoid exaggeration in describing the things we have found and reported, and recommend only those things which we trust will be taken as one more step in bettering the conditions of those who labor.

The conclusion is irresistible that "one day's rest in seven" can be granted in this business, if for no other reason because it is already in force in certain establishments, and we therefore recommend a change in the law which shall take from the present statute the exemption accorded to hotels and restaurants, and recommend the passage of an act similar to House Bill No. 138 of the year 1916, under petition of the Massachusetts State Branch of the American Federation of Labor.

The change in construction of buildings occupied for hotel purposes requires more study than the Board has been able to give in the time allotted by the last Legislature.

The necessity for this change will, we think, appeal to both hotel manager and employee, and we trust some means may be taken to bring this important question before the Legislature after such investigation is made.

The report relative to food and lodging will, we feel certain, lead to the conclusion that education in legislation will cure the evils to which we have pointed in this report.

Respectfully submitted,
State Board of Labor and Industries,
By Edwin Mulready,
Commissioner of Labor.

Jan. 20, 1917.

Industrial Development Division.

The Industrial Development Division has continued its work of encouraging the development and assisting in the progress of Massachusetts industries.

During the year 1916 we have published the results of our investigation on "Unemployment." About 2,000 of these pamphlets have been distributed by the department, and many letters have been received praising this work as a most important contribution on this very interesting subject.

During the same year, due to the railroad congestion in the United States, embargoes were declared on many of the roads serving the interests of Massachusetts. Before the situation became too serious the Board of Labor and Industries endeavored to secure first-hand information on the injury inflicted by the embargoes on our industries. The official inquiry carried out by the Board was brought to the attention of the railroads entering the Commonwealth, and we understand that the prompt lifting of the embargoes was due, to a great extent, to our efforts.

Our translation service has been widely used by manufacturers and exporters of the State. Letters have been translated from and into foreign languages at moderate rates. The service is steadily increasing, and we are being called upon to take care of a greater number of letters than ever before.

The department has encouraged firms wishing to establish themselves in Massachusetts by pointing out that the laws that affect the industrial life of the State are a benefit both to the manufacturer and to the workingman, and we have also co-operated in the endeavors of some Massachusetts producers to find a market for their goods in other States of the Union.

Most important among the endeavors of our Industrial Development Division has been the work done to familiarize merchants, importers and manufacturers of foreign countries with the facilities that the department has to offer them in obtaining goods manufactured in this State. We have already sent nearly 1,500 circulars to the merchants, dealers and manufacturers of South America. In answer to these circulars, which were written in Spanish, we have received numerous inquiries for goods. In our "Trade Opportunities" we have informed manufacturers of the markets that are offered for their goods in foreign countries.

A table of the "Trade Opportunities" sent by the department follows: —

	No.	Concerns.
"Trade Opportunities" sent to Massachusetts manufacturers directly interested.	240	-
Number of concerns to whom "Trade Opportunities" were sent,	-	8,916
Character of opportunities: —		
Domestic,	74	1,255
Foreign,	166	7,661
Abyssinia,	1	135
Argentina,	18	866
Australia,	7	534
Austria Hungary,	1	159
Bolivia,	2	136
Brazil,	5	188
British Honduras,	1	33

	No.	Concerns.
Character of opportunities — *concluded.*		
Ceylon,	1	3
Chile,	7	299
China,	2	24
Colombia,	5	533
Costa Rica,	1	20
Cuba,	8	175
Denmark,	4	179
Dominican Republic,	3	54
Dutch West Indies,	1	46
East Coast, South America,	1	111
Ecuador,	1	93
Egypt,	4	283
England,	7	273
France,	3	146
Greece,	4	97
Guatemala,	4	247
Haiti,	1	36
Hawaii,	1	100
India,	10	373
Ireland,	2	47
Italy,	7	357
Jamaica,	1	21
Japan,	1	20
Mexico,	4	80
Netherlands,	6	558
New Zealand,	1	42
Norway,	2	25
Peru,	6	467
Porto Rico,	1	80
Russia,	6	158
Russia in Asia,	3	163
South Africa,	2	94
Spain,	18	321
Uruguay,	1	51
West Africa,	2	34

CONCLUSION.

In concluding this report the Commissioner desires to acknowledge his appreciation of the assistance which has been received from every member of the department. The deputies, the office force and the inspectors have each contributed to the work accomplished, and the report would not be complete without an acknowledgment of the services rendered.

It is hardly necessary to add that each member of the State Board of Labor and Industries has made less difficult the work of its executive officer by suggestion, advice and encouragement, for which the Commissioner desires to thank the members sincerely.

Respectfully submitted,

EDWIN MULREADY,
Commissioner of Labor.

REPORT OF THE DEPUTY COMMISSIONER OF LABOR (MEDICAL).

To Mr. Edwin Mulready, *Commissioner of Labor, 1 Beacon Street, Boston, Mass.*

I respectfully present the following annual report of the activities of this department which come under my supervision and concern the "health of persons employed in buildings used for industrial purposes."

Ventilation.

Approval of Plans.

Early in the year the Board secured the services of an engineering expert as consultor in passing upon plans for the ventilation of toilets. This opportunity to secure an approval of ventilating plans before the work of construction has begun has been accepted extensively by manufacturers, property owners and architects. It offers to the owner of establishments coming within the provisions of the law the advantage of the advice of an especially trained sanitary expert engineer, and thus reduces to the minimum all possibility of the installation not meeting the requirements of the "Rules and Regulations on Ventilation of Toilets in Industrial Establishments."

Industrial Health.

Prohibited Employment.

During the year certain establishments and employments were investigated in order that the question of including such establishments and employments in the list of employments prohibited to minors by the provisions of chapter 831 of the Acts of 1913 might be decided. There were 90 orders issued to employers to discontinue the employment of minors on, about or in connection with certain machines mentioned in the act as prohibited employments for minors of specified ages.

The question of excluding minors under sixteen years of age from employment in the tobacco fields, as well as "in stripping, assorting, manufacturing or packing tobacco" (sect. 3, chap. 831, Acts of 1913), became an issue in the tobacco centers of the State where a large number of minors were employed in the fields during the tobacco harvesting season.

This question will undoubtedly command more attention in the future, and a special report with description of the process and incidental hazards will be found in Appendix D.

Ventilation of Factories and Workshops.[1]

Efficient ventilation of factories and workshops is essential for the maintenance of the health and comfort, and therefore of the efficiency and capacity, of the workers. The object which ventilation seeks to secure is twofold; viz., the removal of foul, exhausted or polluted air, and the supply of fresh air in its place. This must be not only clean, but must also be stimulating.

By clean air is meant freedom from carbonic acid given off in the breath of human beings, or by fires, gas lights or any other form of open combustion. Just in proportion as carbonic acid exists in the atmosphere, so in like proportion is there parallel diminution in the oxygen of the air. This is very important, as the chemical changes are not perceptible by the senses and hence are often overlooked. While it is undoubtedly true that the so-called "crowd poisoning" may be harmless in itself, nevertheless it excites the feeling of discomfort in many persons that amounts to nausea, headache, faintness and inefficiency. In badly ventilated workrooms the possibility of the spread of bacteria diseases, such as common colds, sore throat and influenza, is very great, and these diseases are the causes of much broken time and loss of employment. Many industrial processes give rise to a variety of impurities, dust and fumes. Some of the most common of these impurities are injurious simply because they are unpleasant, *e.g.*, amyl acetate, acetone, oil of citronella and other volatile oils; others are directly harmful, *e.g.*, fumes from stoves, smoke, dust, etc.;

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[1] Most of the description of ventilation and lighting is from a most admirable report issued recently by the Committee on Health of Munition Workers, England.

while a still further group are directly poisonous, *e.g.*, fumes of lead, brass and of various benzene (coal tar) and benzine (petroleum) derivatives.

By a stimulating atmosphere is meant one that gives to the senses the stimulation of "freshness." It is a common error to believe that because a workshop has so large a cubic capacity in relation to the number of work people and the kind of process in operation that it does not require any definite ventilation. The truth is that there is a mass of stagnant atmosphere in such large shops which is very depressing and relaxing, and fails entirely to provide the stimulating effect of cool air in gentle motion. It is now accepted quite generally that the exhilarating influence of atmosphere depends essentially upon the cooling of the skin by moving air, and is closely connected with questions of temperature and heating. It is a matter of common experience that damp warm air is more relaxing than dry air at the same temperature; also, that cold air is more stimulating than warm, and is more conducive to physical effort. It is also an everyday observation that the relaxing effect of a warm damp atmosphere is much reduced if moving air is brought to play on the body, *e.g.*, fanning, etc. All these observations have been fully borne out by direct experimentation in the laboratory and it is now accepted that the desirable atmosphere, both for comfort and efficiency, may be characterized as being —

(*a*) Cool rather than hot.

(*b*) Dry rather than damp.

(*c*) Diverse in its temperature in different parts, and at different times, rather than uniform and monotonous.

(*d*) Moving rather than still.

Closely associated with the question of ventilation is the problem of temperature.

For a shop to be too hot is disadvantageous from every point of view, but the stimulation of an air that is too cold may be counterbalanced by the physical depression which results, and efficiency is destroyed because the worker becomes uncomfortably chilled. It is not possible to define "best" temperature, since this must be subject to wide variations with the character of the work and the habit of the worker. It can be stated generally, however, that sedentary workers require a warmer atmosphere than those engaged in more violent labor. This makes it most difficult to secure conditions satisfactory in a workshop where there are two classes of workers, *i.e.*, the sedentary and the very active. The result is usually that neither class is satisfied. Many authorities suggest that where the air is stagnant the temperature should not exceed 60° F., and this temperature may be somewhat higher where the air is kept in motion.

The problem of heating and ventilation, therefore, appears to resolve itself into various forms according to the variation in local conditions, — cubic capacity and the shape of the workroom, the nature of work, the number of workers, the situation in relation to other buildings and hills and valleys, topographical position, season of the year, climate, etc. Each workshop provides a separate problem, and there is probably no uniform and stereotyped method which will give satisfactory results everywhere. It may be said, however, as a general proposition, that—

(*a*) Local sources of impurity and heat production should be dealt with by the provision of hoods, exhausts, flues, etc.; smoke and fumes from neighboring workshops and chimneys may require attention; workers should be so arranged in relation to each other that they do not cough and sneeze in one another's faces.

(*b*) Definite openings communicating with the outside air should be provided in every workshop. The form and nature of such openings depend upon the construction and situation of the building.

(*c*) Fixed openings should be supplemented by the use of doors, windows (which will open) and fans. Fans are especially valuable to meet emergencies and abnormal conditions, and provide for a thorough cleaning of the air during meal times.

Many problems of ventilation resolve themselves into localized exhaust ventilation. Here the essentials are —

(*a*) A duct along which a flow of air is maintained in a definite direction.

(*b*) A localized opening or openings in this duct, through which sufficient air is admitted to allow the flow of air to be maintained.

The air so admitted carries with it any dust or fumes the removal of which is desired; *e.g.*, dust, heated fumes and volatile vapors.

The removal of dust is best effected by an air current produced by mechanical power, preferably by a pressure fan, and so arranged as to prevent the dust particles escaping from the place where they are produced into the general atmosphere. The hoods of such ducts must envelop, so far as practicable, the seat of origin of the dust. In the case of dust from a revolving wheel the hood and duct should be placed to intercept the dust which is thrown tangentially from the wheel, and to catch dust which would otherwise fall to the ground. Where dust is created by manual labor the operative should stand or sit facing the opening of the hood, so that the current of air will draw the dust away from him.

The removal of heated fumes may be effected without using mechanical power, but to attain this end the duct should be vertical, of ample diameter and height, and surmounted by a suitable wind cowl. This duct should open into a bell-shaped hood over the origin of the heated fumes. Very frequently the opening to the hood is too large, and the air currents in the workshop carry the fumes away before they come under the influence of the draught; or the sides of the hood are too nearly horizontal, thus making the area within the hood too small; or the height of the vertical shaft, or duct, is insufficient; or provisions are not made to avoid down draught due to wind.

Volatile vapors, especially those of the benzene group, and those that are heavier than air, require openings to the duct at the ground level, and as near as practicable to the place where the vapor is given off. The air current must be so arranged that large volumes of air are drawn away, and ample openings for incoming air must be arranged high up in the workroom. Failure to observe the fact that the vapors and fumes are heavier than air, and consequently must be removed by a downward draught, has resulted in much complaint against very extensive and elaborate systems of ventilation installed to remove fumes and vapors in industrial establishments. Failure, also, to observe the size of openings for incoming air in the workroom is another frequent cause for the inadequacy of many ventilating systems. In order to avoid draughts, such openings should be placed as far as possible from the exhaust openings, preferably on the opposite side of the workroom, and such openings should be equal in area to three times that of the exhaust openings. The location of many workshops requires the use of a pressure fan to drive the air through openings.

Many exhaust systems admirably planned and rightly installed fail to give satisfaction because of lack of attention to details, viz.: —

1. The hood to collect dust may be too small, in which case the dust flying from a wheel is not intercepted.

2. The shape of the hoods may be faulty, in which case dust accumulates on the sides of the hood; or, in the case of heated fumes, the expanding gases escape from the hood.

3. The duct openings may be so small that dust collects there and blocks the opening.

4. The inlets to the work place may be insufficient to admit freely the amount of air required.

5. Bends in the ducts, if too sharp, impede the flow of air, or finally, hoods are frequently detached from ducts, holes broken into ducts, and ducts blocked with machinery débris, etc.

In conclusion it can be said that nearly every work place where localized exhaust ventilation is required presents several problems of its own for the solving of which technical advice is necessary. Much benefit, however, can be guaranteed from exhaust systems installed if the duty of inspecting and of all testing, at stated intervals, is placed in the hands of one responsible person.

Dust and Fume Removal.

There have been several special studies made of dust and fumes so far as these factors bear directly upon industrial health.

1. *Trinitrotoluene Fumes.* — The manufacture of this compound was the source of much study and investigation in order to reduce the hazard to health and life associated with these fumes.

Late in 1915 cases of fume poisoning were reported from a plant that had been established in the State earlier in the year for the purpose of manufacturing T. N. T. and other benzene derivatives.

An investigation showed that the nitration was being carried on in a building erected for this special purpose. No provision had been made for ventilating purposes other than by open doors or windows. Cases of fume poisoning were frequent. A description of these cases will be found in this report under "Occupational Diseases." The only facilities for caring for the men overcome by fumes were under the direction of a member of the guard. The first-aid kit was locked in a small pump room. In cases of serious accidents a physician was to be called from a neighboring city. Orders were issued for ventilating the premises adequately so as to reduce the health hazard, and special instructions were given to employees and employers concerning signs, symptoms, treatment and prevention of fume poisoning.

The plant and the employees were placed under constant medical supervision.

A sheet-iron building was erected to be used solely for medical purposes. The following is a brief description of this hospital's accommodations:[1] —

It consists of a four-bed ward, in which are also kept, because of lack of room elsewhere, the operating table and instrument cabinet; a room for first aid, possessing all the supplies and equipment of the out-patient surgical room of our largest hospitals; with the addition of two lungmotors; a pharmacy for the medical and surgical supplies, with facilities for making and compounding any preparations that might be needed, together with an ice box and an electric range; a bathroom containing a full-length tub and a shower bath. In this room there is also a high-pressure steam sterilizer. The resident surgeon has an office, with scales, clerk's desk and filing cabinets, and a small laboratory which is equipped with all reagents for ordinary work, a microscope and a water-power centrifuge. The seventh room is set aside as a living room for one of the first-aid men. On the west end of the building are a piazza and a fumigator for fumigating mattresses. A large electric fan gives ventilation. There are linoleum floors in three rooms; the others have hard wood.

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[1] Dr. F. O. West, Boston Medical and Surgical Journal, Dec. 21, 1916.

The personnel of the medical staff was also enlarged. On February 1 the writer was appointed resident surgeon, and devotes part of the day to the plant, and is on call for accidents. The first-aid force became separated from the guard and was increased to three men, one of whom was a pharmacist. With one man sleeping in the hospital during the night, we have a service with two men available at all times. To handle properly the vastly increased clerical work, our department has a clerk who devotes his entire time to the work made necessary by the many reports required, and by our complete system of case records.

In addition to this well-equipped hospital that is able to handle, for a time at least, the most serious accidents, and keep for any length of time accidents that do not require expert nursing, we have established emergency stations in all the buildings, which have reagents suited to their peculiar needs. These racks are inspected daily by a member of the hospital department, and all reagents kept supplied. On the daily rounds of the plant this man comes in constant touch with the workers, and is able by constant reiteration to educate them in their personal care.

The first-aid racks are intended simply to relieve at the time of accident; further treatment is carried on at the hospital. Employees are instructed to report immediately after the accident, and not to let even the slightest scratch go untreated. To our vigorous campaign we feel confident the absence of infected wounds can be attributed. Of the 1,648 accidents treated from March 1 to October 1 we have not had a single infected wound when the man reported at the time of accident, and only two infected wounds due to failure to report till infection set in. One of these was a septic hand, occasioned by an employee attempting to remove a splinter from his palm with a dirty tobacco knife; three days later he reported for the first time with a palmar abscess. The other case was a septic finger; infection entered through a small abrasion, which was neglected. This man also failed to report till his finger became swollen and painful.

In cases where it seems inadvisable for the injured to return to his home, either because he needs observation as a result of "fume" poisoning, or because rest is needed, the patient is put to bed in our ward and is kept as long as required. As before mentioned, in cases of grave nature demanding expert nursing the patient is transferred to a hospital. If a man demands to be sent home and requires further treatment he is cared for there. An X-ray apparatus, the property of the resident surgeon, is available when needed, and all fractures and doubtful cases are so examined.

In addition to ventilating the T. N. T. building, plans were made for heating and ventilating the picric acid building at this establishment.

While the installation of the ventilating system was being carried out a fire destroyed the T. N. T. building. This building was rebuilt, and was destroyed again by an explosion in February of this year, since which time the manufacture of T. N. T. has been discontinued at this plant.

The system of heating and ventilating the picric acid plant was completed early in March. Since that time the number of cases of fume poisoning at this establishment has been reduced greatly.[1]

2. *Foundry Fumes.* — Several investigations of foundries have been made during the year because of complaints that employees were suffering from fumes generated in the process of manufacture. In general, the cause of the complaint centered greatly over the fact that in many furnaces and forges oil and coke are used as fuel. In the early hours of the day, or on days when the atmospheric conditions favored stagnant air, the fumes collecting in the atmosphere were greatest and the cause of much complaint. This is particularly true at the beginning of the cold weather, when the doors and windows are shut. In two establishments the trouble was found to be caused by the blast furnaces. These furnaces were provided with hoods, but not of sufficient area to extend over the furnaces and take up the gases that were given off. This allowed the escape into the room of much fume. Good results were

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[1] See Bulletin No. 11, issued, by the Board, "Rules and Regulations for Safety in the Manufacture of Benzene Derivatives and Explosives."

obtained by providing shields on one side of the forge so as to direct the gas into the hood. In other establishments the installation of fans greatly aided the dissipation of the fumes.

The Rules and Regulations relating to working conditions in foundries, now in the hands of a committee working with the Board, should reduce greatly this source of complaint.

3. *Laundry Fumes.* — The extensive use of gas as a fuel in laundries and bakeries has given rise to several complaints during the year because of the amount of sickness and ill health among employees working in these establishments. The case of a large shirt factory describes fully this problem.

The process of manufacture carried on here consists of ironing shirts preparatory to placing them on the market. This ironing is done by fifty-six men and forty-two women. Each worker has a stove arrangement carrying two flatirons. The heat for each stove is from the gas flame. By a mechanical arrangement the placing of the iron on the stove presses a plug which liberates gas, and this gas is ignited by a small pilot light which is kept lighted all the time. The possibility of the escape of gas at this point, because of the small fraction of time between the turning on of the gas and its ignition, would seem to be very small. Nevertheless, the constant repetition of this process by so many employees establishes the possibility of considerable carbon monoxide getting into the air during the day's work. This contamination is increased greatly in the earlier hours of the day, before the stove and the cold irons become heated. In addition to this possible source of fume contamination there is the possibility of leaky pipes and joints.

Carbon monoxide gas is a real source of danger to industrial health because of its extensive use to-day. The large number of suicides in Massachusetts yearly by illuminating gas inhalation shows this gas to be highly poisonous in the proportion of carbon monoxide contained.

Two preventives are suggested: —

First. — The substitution of electricity as a heating power.

Second. — The installation of adequate ventilating and exhaust systems at or near each point on the stove where the possibility of the escape of gas exists. Constant vigilance of the possibility of leaky joints is very essential to guarantee protection against this source of industrial poisoning.

4. *Printing Office Fumes.* — Complaints received during the year from various printing establishments because of the presence of fumes in both the composing room and the photogravure department caused these establishments to be especially investigated.

In the linotype room and monotype room, as well as in the composing room, it is a question of adequate fume-exhaust system wholly. In the photo-engraving room, however, the problem is one of more seriousness. Briefly, the process of photo-engraving is as follows: —

The copy is photographed by means of the wet plate process: the negative is dried and treated with a solution of rubber and collodion; the negative is then stripped from the glass on to a thicker glass. The negative is then dried and put in contact with a sheet of zinc or copper which is coated with a sensitizing solution, and the image printed on the metal by means of high-powered electric lights. When printed the plate is developed by means of dye and water, and then heated until the solution is in a state to resist the acid. The plate is then placed in a bath of nitric acid and etched. When etched deep enough the plate is then routed deeper by means of a routing machine, which has a tool that revolves about 2,000 revolutions per minute. The plate is then placed on a base and is ready for printing.

The plate goes through a series of what is known as branches of the trade.

During the process the chemicals and acids used by the several workmen are as follows: By the photographer: collodion (consisting of a mixture of grain alcohol, ether, guncotton and chemical salts), potassium cyanide, copper sulphate, silver nitrate, iodine and potassium iodide, mercuric chloride, lead nitrate, potassium ferricyanide, sodium sulphide, hydrosulphite of ammonia, ammonia. By the negative turner: collodion, liquid rubber, acetic acid. By the etcher: nitric acid, dragon's blood, dyes, chromic acid, citrate of iron and ammonium.

Besides the dangers caused by improper ventilation of fumes from the various chemicals, acids and powers there is the added danger of chemical burns and poisons, and the possibility of eye injury from the ultra violet rays from the arc lights, as well as of injury from zinc chips given off by the machinery.

5. *Wood Alcohol Fumes.* — The use of wood alcohol, as well as ethyl acetate and amyl acetate, in the shoe industry has increased during the year because of the substitute of fiberloid compounds.

Complaints have arisen from the use of these substances. The most notable case, however, was in a fiberloid establishment where wood alcohol was used extensively, and a case of total blindness, alleged to be due to the wood alcohol, reported to this department.

The fiberloid compound requiring this solvent is made substantially as follows: cellulose, in the form of fine chopped-up paper, is treated with a mixture of nitric and sulphuric acids. After nitration, the product is thoroughly washed, dried, ground and mixed with other chemical ingredients, the nature of which is kept secret. Camphor is used in the process for the purpose of accelerating the solution of the nitrated cellulose. The various ingredients are mixed with wood alcohol as a solvent. The product is further moistened with wood alcohol during the milling process and rolling process. This alcohol is brought in by an operator in small cans, some of which resemble watering cans with a perforated nozzle. Other establishments use the ordinary tin can without a cover. As the batch passes through the rolls the men pour the alcohol over it and repeatedly pass the fiberloid through the rolls until the desired consistency and plasticity are obtained. There is much heat generated in this process, which results in the evaporation of the solvent. There are, therefore, three sources of wood alcohol fumes in the mill room, viz.: —

(1) From evaporation from the chemically mixed batches contained in each box-like receptacle.

(2) From evaporation of the wood alcohol from open containers from which the batch in the mills is moistened.

(3) From evaporation of the wood alcohol from the warm fiber as it passes through the rolling mill.

The dangers from wood alcohol in the fiberloid establishments can be reduced to a minimum by means of suitable exhaust systems.

In the shoe industry, however, it becomes necessary to secure some substitute for wood alcohol as a solvent for the fiberloid used in shoe making. This substitute is principally ethyl acetate and acetone with a small trace of methyl alcohol (wood alcohol) in the proportion of three parts by volume of acetone and two parts by volume of ethyl acetate, or two parts by volume of acetone and one part by volume of ethyl alcohol. In one shoe establishment the solvent used had as much as 15 per cent. wood alcohol.

In this connection it might be stated that ethyl acetate, while capable of causing headache, dizziness and slight irritation of the eyes, is not considered capable of causing disease. The pungent odor, however, can give rise to much discomfort as well as to psychic and nervous symptoms, and its result on the health and comfort of the workers is at times the cause of sickness and absence from work. This, however, must not be confounded with industrial poisoning, as ethyl acetate does not produce poisoning. Amyl acetate may produce headaches and other symptoms when the fumes are inhaled in relatively large amounts. In the solution analyzed the portion of amyl acetate was very small, less than 2 per cent. The presence of ethyl (grain) alcohol fumes may give rise to irritation and cough, especially when present in such large proportions as 60 to 70 per cent., as in one solution that was analyzed and used in one of the shoe factories.

Acetone, which is one of the ingredients in most of the solutions used, has gained considerable prominence in medicine as a supposed cause of disease, especially in diabetes. The truth, however, is that the medical profession and investigators are now practically unanimous in the opinion that acetone is a result of this and other diseases, and not a cause of the symptoms of disease. The best authorities state that accidental poisoning with acetone is unknown.

The conditions of safety relative to wood alcohol would seem capable of being summarized as follows: —

(1) Eliminate as far as possible the odors which give rise to the psychic symptoms complained of by so many persons work-

ing in atmospheres where wood alcohol and other solvents are used.

(2) Reduce the proportion of wood alcohol to less than 2½ per cent. or better still, use alcohol denatured with other substitutes than wood alcohol.

(3) Use acetone chemically pure.

(4) Use boxes containing the liquid so as to prevent, so far as possible, the escape of fumes into the atmosphere.

(5) Eliminate amyl acetate so far as possible because of its odor.

(6) Install adequate exhaust system near the point of application of the fluid, especially in the shoe industry, where the fiberloid material is moistened with a solution, and where considerable evaporation of the solvent solution takes place.

6. *Salamander Fumes.* — The use of salamanders in drying plaster during building operations has given rise to ill health among plasterers and others working on staging in rooms where these heaters are employed. One plasterer was so overcome by the fumes from the coke used in the salamander that he became nauseated, dizzy, and, falling to the floor from the staging, received a severe concussion of the brain. Many of the rooms in which salamanders are used have either temporary windows or cloth screening in windows, during the building operations, in order to facilitate drying of the plaster. The salamanders are kept burning continuously day and night, and give rise to much carbon monoxide fumes which accumulate during the night. Men entering these rooms, especially when compelled to work on staging in such enclosed rooms, are very liable to fume poisoning.

To prevent this possibility, the following rule and regulation was passed Aug. 1, 1916: —

> When heating apparatus is used for the drying of plaster or other material it shall be so piped as to convey smoke and gaseous matter to the outer air.[1]

7. *Paranitranilin Fumes and Dust.* — Attention was called to evidence of ill health among employees in an establishment

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[1] Bulletin No. 8.

where experimenting in the manufacture of paranitranilin was being conducted.

The process of manufacture is briefly as follows: —

Aniline oil is brought to the establishment in flasks. It is mixed with equal parts of glacial acetic acid, boiled for four days at a temperature of 180° C. It is then filtered, which gives a dry powder called "acetaniline." This powder is cut with vitriol before nitration, and stands in vats packed in ice so as to maintain a temperature of 30° C. It is then nitrated with two parts of nitric acid and one part of vitriol, the process requiring ten hours. The nitrated solution is pumped into water boiled to 120° C., purified in caustic soda solution, filtered, extracted and dried. The dried powder is a granular powder, "paranitranilin."

Another preparation, called "indoline," used in the same establishment, is made from equal parts of aniline oil mixed with hydrochloric acid (28 per cent.), boiled at 220° C. for eight hours, neutralized and precipitated by adding more hydrochloric acid. The product is then filtered and dried. The employees at this establishment showed signs of aniline poisoning. In six months, viz., between March and September, 1916, forty-nine men tried to work in this establishment, and were compelled to discontinue. Some men worked two hours, others two days.

Large quantities of hydrochloride of aniline in the powder form are deposited on the floor waiting shipment to other establishments, this product being a by-product of the manufacture of paranitranilin.

The above hazards were removed by the installation of a ventilating system, by furnishing to employees running hot water for washing purposes, by furnishing gloves and boots, and by making provisions for eating luncheon outside the workroom.

8. *Dust Hazard.* — Several investigations have been made relative to dust in various industries and its effect on the health of the workers. The results of some of these special investigations are given in this report under appropriate headings.

The following report gives a description of two dusts differing radically in their composition and in their effects upon the workers: —

(*a*) Asbestos dust: An establishment manufacturing asbestos fabric was the cause of serious complaint because of the particular nature of the dust generated in the process of manufacture.

Crude asbestos is woven into cloth. Weaving process is continuous night and day. Looms are attended by women in the day time and by men at night. Considerable humidity is required for this type of work. The atmosphere is constantly filled with the fly and fiber of the asbestos. After the asbestos tape is woven and wound on to reels it is taken into the naphtha room, where it is run through a black bath which is very much thinned out with naphtha. From this bath the tape is run through oven driers. These large oven compartments have a fan and motor attached. In the same room asbestos lacings are dried by being stretched on frames and dried by the atmosphere. The room is filled with naphtha fumes. After the drying process the tape is sent through a chute to the basement floor, where it is given another baking process in two large ovens. Here the fumes are so powerful that men complain that they cannot open the doors of the oven and stay inside the room. It is also said by the workers that the atmosphere is so dusty at times that they can scarcely see an object 5 feet ahead. Constant complaint is made of headaches and coughs, and many complain of being frequently nauseated.

One form of asbestos tape has copper wire woven into the tape. In this process we have both dust and fume hazard, each of a severe type. The question of suitable exhaust to carry off this heavy dust has many difficulties because of the nature of the dust, *i.e.*, very heavy, and the fact that much moisture is required for the manufacturing process.

(*b*) Antimony dust: Two cases of gas poisoning reported brought out the fact that these men were poisoned by hydrogen sulphide gas resulting from the process of manufacture of an antimony powder to be used in coloring rubber red. This, as in the case of paranitranilin fumes, was in an establishment where experimentation was being carried on.

The process of manufacture is, briefly, as follows: —

The antimony is ground up in a crushing machine, and this powder is placed in large vats diluted many times with water.

Sulphuric acid is mixed with this paste, and a beautiful golden color, monochloride of sulphur, results. The sulphuric acid is drawn off at a particular stage of the process, and the precipitate is put through a water filter press, which results in a crimson antimony powder known as "sulphide of antimony." The process of milling and grinding of this antimony powder is a very dusty one, and one capable of causing much poisoning, as it is well recognized that antimony powder is soluble in the gastric juice in the quantities varying from 3 to 8 per cent.

The hazard from this possible source of poisoning was reduced greatly by the installation of a blower system, and by providing the men with respirators.

9. *Prevention.* — In order to reduce to a minimum the possibilities of gas and fume poisoning in the various industries in the State, a tentative set of Rules and Regulations was prepared and distributed to the various manufacturers, especially those manufacturing benzene derivatives.[1] These suggestions have been quite generally adopted by the manufacturers, and have resulted in reducing greatly the number of cases of gas and fume poisoning.

To reduce the hazards to health resulting from dust the following information was presented in a small pamphlet form for insertion in the pay envelope: —

Some Facts about Dust and Your Pay Envelope.

To the Wage-Earner.

The State Board of Labor and Industries asks your co-operation in fighting dust and its diseases because —

Dust is one of the great enemies of industrial workers. It destroys the power of the body to fight disease by clogging up the human machinery; it carries germs of disease into the system and gives them a breeding place to poison the worker until he is not fit to work. This means a small pay envelope. It often means the loss of your job.

Dust is present in nearly every kind of work.

Dust from cotton, wool, fur, flax, hair, jute, shoddy, asbestos, feathers, leather, wood, rubber, talc, tobacco and minerals breathed into the lungs causes catarrh, bronchitis and favors consumption.

Dust from glass, coal, steel, granite, marble, silica, flint, bone, celluloid, shell, ivory, metal filings, emery, pumice, enamel, broom and straw, grains, cement, limestone and sand cuts the delicate lining of the nose, throat and bronchial tubes, and this lets into the system all kinds of disease germs floating through the air.

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[1] Bulletin No. 11.

Dust poisons such as lead, arsenic, mercury, brass, anthrax, shellac, wood alcohol, banana oil, aniline, chrome and other dyes are carried by food eaten from hands dirty with these poisons.

Dust poisons, such as aniline oil and dye, picric acid, carbolic acid and other chemicals, cause disease and death by being absorbed through the skin.

Adequate Lighting.

The question of eye strain as a factor in industrial fatigue is receiving each year more and more attention. While the statute in Massachusetts does not specify any particular standard of lighting in the various lines of industry, nevertheless inspectors visiting the establishments throughout the State have made note of the degree of light, both artificial and natural, in various establishments and in different parts of the same establishment.

These observations have been passed on to the manufacturer, and in many instances have resulted in greatly bettering the lighting condition in the establishment. Frequently closer attention to the cleaning of windows has added much to the light content in rooms. In other instances rewhitewashing walls and ceilings has aided greatly, while in some special departments — especially in departments where hoods over machinery, *i.e.*, emery wheels, buffing wheels, etc., have been installed — the workman has been aided greatly by having the machine so placed that light fell upon the field of his work. Much of the complaint received — that workmen will not use the hoods provided for machines of this type because such hoods obstruct the light — is due to the fact that the machines are so placed that the hood casts a shadow upon the field of work. This same malposition of machinery prevails in textile industries quite generally. The frames, looms and other machinery are placed parallel to the windows, thus giving to the rear of the machine, where no work is carried on, the maximum of light from the windows, while forcing the employee to work between machines that exclude almost exclusively the natural illumination. This arrangement results in greatly fatiguing the worker because of the constant eye strain involved, and it is unquestionably a big factor in the causation of many accidents by machinery.

The essentials of good lighting may be summarized as follows: —

(*a*) Adequacy.

(*b*) A reasonable degree of constancy and uniformity of illumination over the necessary area of work.

(*c*) The placing or shading of lamps so that light from them will not fall directly on the eyes of an operator when engaged on his work or when looking horizontally across the workroom.

(*d*) The placing of lights so as to avoid the casting of extraneous shadows on the work.

Natural lighting is to be preferred to artificial lighting, both on the grounds of health and economy. Roof lighting is generally to be preferred to lateral lighting, as in such lighting (roof lighting) illumination is very uniform. Factory lighting by means of a large number of windows on one side of the building is very common. This means of lighting is limited greatly by the width of the room, also by the nature of the work to be done, and by the surrounding buildings. The effect of light-colored walls and white ceilings, affording an effective background to dark objects, is not generally appreciated.

Natural lighting may be improved in any establishment by deflecting vertical light into the room by means of reflectors or prismatic glass, or by whitening the surface of an external wall or building which obstructs the light.

In accordance with the provisions of section 1, chapter 603 of the Acts of 1911, a set of "Suggestions to Employers and Employees for the Protection of Eyes and the Prevention of Accidents"[1] was prepared and distributed quite generally throughout the industries.

SANITATION.

A special investigation of the sanitation of the textile industries of Fall River was made in order to learn the general situation relative to the source of drinking water, water used for humidifying purposes, as well as washing facilities installed in these various establishments. The result of this investigation is appended to this report under Appendix D.

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[1] Bulletin No. 5.

In order to secure suitable drinking water in 94 different establishments throughout the State it was necessary to issue orders to the manufacturers. In each case the order was complied with. The regulation concerning the supplying of hot running water in establishments where the manufacturing process is particularly dirty is quite generally observed throughout the State, especially in establishments where the handling of poisonous substances might result in conveying those substances into the system by means of food.

Toilets.

During the year 3,344 orders were issued for the installation of toilet accommodations in accordance with the Rules and Regulations of this department.

As pointed out in the beginning, wherever extensive changes are necessary in order to meet the requirements, plans for such changes are presented to the consulting engineer for approval. In only one instance has it been necessary to resort to prosecution in order to secure suitable and adequate toilet facilities for employees. The court gave a decision in this case sustaining the "Rules and Regulations for Toilets in Industrial Establishments" as adopted by the Board in 1914.

Medical Chest.

There have been 1,078 orders complied with by different establishments to install medical and surgical chests for the treatment of persons taken ill or injured on the premises. More than 300 establishments have organized "welfare departments" under the supervision of either physicians and nurses, or nurses and foremen or forewomen.

The appointment of nurses to various industrial establishments not under medical supervision has given rise to considerable controversy because of the responsibility associated with such appointment. It is the general opinion that all nurses engaged in welfare work in industrial establishments should work under the direction of a physician, who should be held responsible for the treatment given and for the after-care of injuries received.

Expectoration.

Much of the beneficial results looked for from the law that "No person shall expectorate or spit, except in receptacles provided for the purpose, in or upon any part of any mill . . ." is lost in the division of the authority that gives to the State Board of Labor and Industries the enforcement of the law against expectoration, but places with the local boards of health the authority for describing the form and construction, as well as deciding the number of receptacles to be installed in factories and workshops. Few local boards of health have decided these questions; consequently, efforts to enforce the law against expectoration amount to very little. The Legislature refused this year again, as in previous years, to place the responsibility of enforcing the anti-expectoration act and the installation of receptacles in factories under one authority, *i.e.*, either the State Board of Labor and Industries or boards of health.

Seats for Women and Minors.

In a large number of establishments visited this year it was found necessary to issue orders for the installation of seats for women and minors in 66 establishments. The past year has served to emphasize the fact that many employments in which women and minors are engaged permit the use of seats without interfering in the least with the efficiency of the worker. It is a source of great satisfaction to note the co-operation of manufacturers in carrying into effect this very beneficial law for the health and comfort of women workers.

Home Work.

It has come to our attention during the year that in many cities and towns it is the practice of the local board of health to quarantine the whole building in which a case of communicable disease exists. This has resulted in great hardship to many holders of home-work licenses, as it has prevented them from receiving home work while the building was under quarantine.

To obviate this injustice the word "household" has been interpreted to mean the "immediate family only," and does not apply to other families living on the same floor or in the same building. This interpretation is in accord with that of the Boston board of health and of several large cities and towns of the State.

The revoking of home licenses because of contagious disease has been based upon this interpretation, and has reduced greatly the number of home licenses revoked (76).

OCCUPATIONAL DISEASES.

Anthrax.

Human anthrax has suddenly become a serious industrial as well as a public health problem in this country. Hides, skins, wool, bristle and other animal products that formerly went to Europe are exported to-day direct to this country. A large bulk of these imports is from places where anthrax is constantly epidemic among cattle, namely, China, Russia, Asia, India, Africa, South America and Australia.

In 1905 England found it necessary to appoint an anthrax investigation board that has since become a permanent advisory committee to the government. In France and Germany the reporting of anthrax is compulsory. In 1913 an international committee was formed representing England, France and Bavaria.

The recent outbreak of human anthrax in Massachusetts shows that the danger is a real one to-day in this country. In Massachusetts there were 27 cases of anthrax reported in the year 1916, 4 cases in 1915 and 4 cases in 1914, making a total of 35 cases with 6 deaths. The average number of cases reported yearly in Great Britain for the period 1900 to 1914, inclusive, was 35.8, or 537 for the fifteen years. The cases reported in England included infection from wool, horsehair, hides and skins, and miscellaneous sources.

As will be shown later in this report many of the cases of anthrax in the Massachusetts outbreak were connected with the handling of a particular shipment of hides. Nevertheless, other cases have been reported which could not in any way be due to hides from the same infected area. It does not seem probable that Massachusetts is the only center of human anthrax in this country. The probable truth is that the disease is far more common in this country than published reports would seem to indicate. There are no regulations against interstate transportation of anthrax-infected materials. Any measures for the prevention of this disease must be national. The health of the community, as well as the trade and industrial problems involved, makes this course imperative. There does not seem to be any necessity for the enactment of laws or regulations that will restrict or hamper any of the industries in their manufacture of any of the animal products. In Massachusetts it has been found that the manufacturers are most eager for information concerning the cause and the spread of human anthrax. They adopted quite generally the precautionary measures suggested, and their co-operation, as well as their close observation of the workmen, has made it possible to institute prompt and reliable medical treatment. The State Board of Labor and Industries met the manufacturers with the same spirit, and the result was a set of tentative rules or suggestions that guarantee protection against the disease among workmen engaged in any of the processes in which anthrax infection is possible.[1]

In the prevention of anthrax among workers there is no necessity for the adoption of any measure that will either injure the material in any way, or will limit or restrict in any degree the various manufacturing processes in which animal products are used.

Any material infected by the blood of an animal which has died from anthrax is capable of transmitting the disease to man. The germ (anthrax spores) may remain active for years. The problem of disinfecting material, so as to guarantee prevention against anthrax, is one of the most troublesome subjects in industrial hygiene. The consensus of opinion to-day seems to be that hides and skins can be disinfected without injury to their future manufacture, and that wool and hair can be disinfected by steam, provided these materials are in a loose state and the steam is under pressure of not more than 17½ pounds. The investigation of the English Anthrax Board seems to have destroyed the theory of "no blood, no anthrax" that prevailed for many years. The Board has cultivated anthrax spores from material in which there was no evidence of blood. This makes the dust problem of prime importance in the handling of hides, skins, wool, hair and other animal products in the dry state.

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[1] Bulletin No. 6.

The following cases of anthrax reported to the Massachusetts Board of Labor and Industries set forth many different types and manifestations of this disease. Anthrax is an occupational disease with which the medical profession is very likely to meet to-day in practice more often than in the past. Much depends on an early recognition of the disease and its probable source of human infection.

Feb. 5, 1914. — Man, age thirty-five, employed as a wagon maker since Aug. 29, 1913. Disease began with pimple on nose, followed by larger one on back of neck. No traceable source of infection. Diagnosis confirmed by skin specialist.

March 2, 1914. — Man, age nineteen, employed in making bags in an upholstering shop since Dec. 2, 1913. He used tow, excelsior, seaweed, horse hair and jute. The leather used was of the fancy assortment, colored. He thinks he contracted the disease from jute. Ulceration on right neck just below angle of jaw. Diagnosis confirmed by hospital.

March 25, 1914. — Man, twenty-one years of age, worked as a handler of morocco hides in tannery since October, 1913. Had sore hands in 1913. On March 16, 1914, he had ulceration on right arm. Anthrax bacilli found.

July 18, 1914. — Man, aged forty years, had worked in a tannery since 1895. For first five years he worked pulling wool, and for the past twelve years has done the grading and sorting of goat skins. He did not wear gloves. On July 13 he noticed a small pimple on his forehead. On this date he worked at grading a lot of hides from South America that had been sulphided (a bath of sulphide of soda, lime and arsenic). He squeezed the pimple sufficiently to open the same. The next day he also worked on goat skins from Eastern Europe, and helped to sort wool as it came from the beamers. His skin eruption was treated at the first aid room for two days. On July 17 his face and cervical glands became so swollen that he was removed to the hospital, where the disease was pronounced anthrax. No bacillus was found.

The appearance of human anthrax in an endemic form in Massachusetts began in July, 1915. The cases reported during the following year are briefly summarized as follows: —

Fatal Case, July 5, 1915. — The daily papers reported that a man, aged fifty years, employed as a longshoreman, died on the previous day at the hospital from arsenic poisoning contracted from handling hides. Investigation furnished the following history: The man entered the hospital in a moribund condition on July 4, and died within a few hours. The diagnosis was œdema of the lungs, multiple contusions and abrasions. An autopsy was secured, and the medical examiner's report states, as cause of death, "internal anthrax." The nature of the disease which caused W.'s death was disclosed only by autopsy. Investigation showed that on May 25, 1915, he worked in the hold of a vessel laden with dried blood, ground bones and phosphate, and subsequently to that date assisted in the discharge of cargoes of dried hides. It was learned later that the man was taken ill on June 30. He was not able to work July 1. On July 3 he complained of headache, and on the morning of July 4 was found unconscious, lying on the floor of his room. He was removed to the hospital and died at noon, July 4.

July 4, 1915. — Man, thirty-one years old, employed for past three years as a weigher of hides and tanners' material as received at the docks. This weighing was done by means of scaffolding tools, balances and hooks. The man had to shift the beam balance and write figures in a book. The hides were chiefly Australian and South American imports. Three days prior to onset of the disease he handled hides constantly, and on June 29 and 30 he assisted in weighing and sorting some Australian calfskins packed in casks. This required considerable handling of the hides. About July 1 he noticed a "boil" on his left forearm near the elbow. On July 3 he became very ill with nausea and vomiting and marked prostration. His condition grew worse, and on July 4 he was sent to the hospital, where a positive diagnosis of anthrax was confirmed.

Oct. 27, 1915. — Man, aged nineteen years, Portuguese, in this country one month, was employed in handling green dry hides in a tannery. He sought medical relief because of swollen glands on left side of neck and the disfigurement by an eschar on forehead. A positive bacteriological diagnosis of anthrax was secured from the discharge. Gloves were worn in the handling of the hides.

Fatal Case, Nov. 23, 1915. — Man, aged thirty-one, employed as a tanner in the fleshing department, was admitted to the hospital on November 20 with swelling of right upper arm. A positive diagnosis of anthrax was secured. The man died on Nov. 27, 1915.

Fatal Case, March 8, 1916. — Man, aged thirty-three years, employed as a currier on leather, claimed that he was struck on the side of the neck with a piece of leather on March 4. The skin was scratched. Considerable swelling resulted in face, neck and chest. He died March 9, 1916. Diagnosis of anthrax confirmed.

Fatal Case, March 13, 1916. — Man, aged thirty-two years, employed for two weeks in unloading of ship's cargo of wool, burlap and hides. He worked two hours on March 9. He recalled having scratched his neck on left side March 7. He carried hides on shoulders two days following this injury. On March 9 a slightly painful "pimple" appeared on site of scratch. Neck became swollen and painful. He was admitted to hospital suffering from slight dyspnœa and marked swelling of neck. He died March 15, 1916. Autopsy confirmed anthrax with associated œdema of larynx and meningitis with asphyxia.

March 14, 1916. — Man, aged thirty-five, employed since Sept. 25, 1915, in the handling of dry hides in the beam house of a tannery. On March 13, 1916, he noticed a small swelling under left jaw. This became tender, and he developed considerable malaise. Temperature 102°, rapid pulse. He was admitted to the hospital, where a positive diagnosis of anthrax was made.

March 15, 1916. — Man, aged nineteen years, employed one month in carrying hides from sulphide bath to fleshing machine; was admitted to hospital March 12 with swollen glands and several small pustules on face and neck. Positive diagnosis of anthrax.

March 17, 1916. — Man, aged twenty-two years, employed for nine months in the beam house on fleshing machine. Was taken ill on March 13 with headache, eruption of skin, enlarged glands. Diagnosis by attending physician, anthrax. No confirmation.

March 21, 1916. — Man, aged twenty-four years, employed for three years in stamping raw hides at tannery. His duties consist in lifting hides from floor, weighing them and placing them on machine that stamps them. He denies having carried hides on shoulder or in contact with the neck. On March 20 he noticed small tender pimple on left neck. No history of previous scratch or pimple. Swelling grew very tender. Was admitted to the hospital March 20. Symptoms were slight sore throat and stiffness of left side of neck. Left arm and top of left chest painful. Glands in left axilla swollen and tender. Positive diagnosis of anthrax confirmed.

March 21, 1916. — Man, aged twenty-four years, employed ten days in handling hides in tannery. Carries hides from one place to another. On March 13 he complained of pain and swelling on left side of neck, with general malaise. Positive diagnosis of anthrax.

March 25, 1916. — Man, aged thirty years, employed since 1908 as a weigher and sorter of hides at dock. On March 22, while handling dry China hides, he had nausea, vomiting, general weakness and eruption suggesting anthrax. The man was sent to the hospital, where a positive diagnosis was confirmed.

March 26, 1916. — Man, aged forty-four years, engaged for nine months in beam house of tannery. Has been using China hides lately. Developed malignant pustule on left side of neck. Removed to hospital March 23. Positive diagnosis of anthrax confirmed.

April 10, 1916. — Man, aged thirty-two years, employed two years in trimming hides in a leather factory. On April 9 he developed malignant pustule. Admitted to hospital. Positive diagnosis of anthrax.

April 10, 1916. — Man, aged thirty-one years, employed two years as teamster about leather establishment. Handles dry hides. On April 7 showed eruption at angle of jaw (left side), with considerable skin involvement. Pulse, 80. Diagnosis of anthrax by attending physician.

April 20, 1916. — Man, aged twenty-one years, employed since Feb. 2, 1916, in handling green hides from soaking pits. Wears gloves and rubber boots. Does not carry hides on shoulders. On April 23 developed a typical lesion on left cheek just below angle of jaw. Had been handling China hides. Admitted to hospital, where a positive diagnosis of anthrax was confirmed.

April 29, 1916. — Man, aged fifty-two years, worked in tannery for twenty-eight years as a "flesher." On April 28 malignant pustule developed on the tragus of the ear. Patient sent to hospital, where positive diagnosis of anthrax was confirmed.

April 29, 1916. — Man, aged forty-one years. Has worked since 1911 in "tan" room of tannery. He used a truck that had been previously used by man (infected) in beam house. A characteristic eruption on left neck appeared on April 27. Man sent to hospital, where positive diagnosis of anthrax was confirmed.

Fatal Case, May 31, 1916. — Man, aged fifty-three years, had worked on fleshing machine for twenty years. On May 31 the man developed a suspicious pimple on the right side of neck near the angle of the jaw. Patient seen next morning and sent to hospital for diagnosis. Smear obtained and diagnosis confirmed. At 2 P.M. on June 2, while patient was drinking a glass of milk, he choked, became cyanotic. Tracheotomy was performed. He died at 3 P.M. Autopsy showed small pustule on right side of neck near angle of jaw, œdema of lungs and larynx, death by asphyxia.

June 1, 1916. — Man, aged twenty-one years. Has been working on fleshing machine in tannery. On May 30 he developed pustules on left angle of jaw and on neck. Sent to hospital, where positive diagnosis of anthrax was confirmed.

June 9, 1916. — Man, aged fifty-six years, teamster for general contractors. So far as could be learned man has had no connection with possible infected material. On June 8 he developed pustule on dorsal aspect of left wrist. Diagnosis at hospital, anthrax. Smear negative.

June 16, 1916. — Man, aged twenty-three years. Has worked three years in the wool cellar of a tannery. His duties consisted of untying bundles of sheepskins. He counts them, places them in the soaking pits, later removes them by hooks, and carts them to the beam house. Worked on China hides. Scratched his right arm on hook. The next day lesion developed (June 12) on right forearm just below the elbow, — black crust, oozing serum, large vesicle about periphery surrounding red zone. Patient taken to the hospital, where diagnosis of anthrax was confirmed.

June 27, 1916. — Man, aged twenty-five years, worked since February, 1916, as a laborer in beam house. Has been in the habit of carrying bundles of hides against right side. His clothes were soaked through constantly on right side. On June 23 he developed a typical pustule on outer aspect of right hip, about border of ileum, had nausea and vomiting, headache and malaise. Sent to hospital, where positive diagnosis of anthrax was confirmed.

Aug. 11, 1916. — Man, aged thirty-two years, employed for the past three years at handling hides as they came from the lime pits where they had been soaking for six days. His work consisted of tacking the hides on sticks and placing them in the tanning solution. On August 9 he developed glandular enlargement (slight), with the manifestation of multiple lesions, which showed anthrax bacilli. There were eight lesions on his neck, cheek and forehead. One large one, the size of a quarter of a dollar on left cheek, persisted for more than two weeks. This case of multiple infection is unusual.

Aug. 27, 1916. — Man, aged twenty-one years, employed for over three months as a sorter of hides after they had been through the vats. He developed typical anthrax, with slight or no discomfort.

Oct. 19, 1916. — Man, aged twenty-three years, employed for ten weeks on a fleshing machine, developed a marked cellulitis of arm. On October 16 there was a definite history of having scratched his arm with a nail while engaged in handling a fresh cargo of South African hides. The lesion was located at site of injury (near the insertion of the deltoid). The pustule was umbilicated with swollen œdematous border. Smear showed bacilli of anthrax.

Nov. 22, 1916. — Man, engaged as a sorter of hides in a leather establishment, developed an anthrax lesion on face. Smear showed bacilli of anthrax.

Nov. 30, 1916. — Man, aged thirty years, employed for three weeks in the beam house of a tannery as a hide handler, developed a typical pustule at angle of right jaw. Smear showed, besides anthrax bacilli, many streptococci.

Nov. 30, 1916. — Boy, sixteen years old, employed for the past five weeks as a "sweeper of the fly" in a woolen weave room, and also as a packer of loose wool into bags. On November 26 he showed a typical lesion which gave the bacilli of anthrax. The wool handled was a particularly greasy grade, and was mixed with jute. The cargo was principally from South America. The boy was found asleep in bags of wool two or three times just prior to the date of his illness.

Fatal Case, Dec. 14, 1916. — Man forty-six years of age, employed as a handler of hides in a tannery, was taken ill from what appeared to be a simple skin infection. A slight redness of skin, general weakness, pulse 80, followed in twenty-four hours by a typical skin lesion. Admitted to the hospital and diagnosis of anthrax confirmed. Patient died Dec. 17, 1916.

The following facts were learned concerning the outbreak of human anthrax in Massachusetts: —

The hides passing through the various tanneries during the period of the occurrence of this disease contained shipments from China, India, Africa, Brazil and Argentine Republic. The shipments of goat skins from Europe to this country were greatly increased. A cargo of hides from Nigeria, Africa, were imported without a consular certificate of disinfection, as there was no consul available at the port of exportation. Some of the hides of this shipment were traced to the factories in Massachusetts where cases of anthrax developed later. The hides were disinfected at the factory here by agents of the United States Department of Animal Industry. A solution of 10 per cent. salt, 2 per cent. hydrochloric acid and water was used. The hides were soaked in this solution for forty-eight hours.

The Brazilian hides came from Pernambuco, Ceara and Bahia. The China hides were chiefly from inland districts. These were sent to Hankow, and from there to Shanghai. The India hides are exported from Calcutta, Akyab and Dacca.

All foreign hides were received dry. The domestic hides were received wet. Cases of animal anthrax had been reported in New York and New Hampshire. Hides from these localities were received in Massachusetts.

Dry hides reach the fleshing machine process usually in eight days after delivery at the factory. Wet or domestic hides require six days for the preliminary steps in manufacture.

The appearance of human anthrax at the different factories coincided with the shipment dates.

An investigation by one of the manufacturers led to experiments by him in which he was able to develop anthrax in guinea pigs by injecting into the peritoneal cavity cultures from the sides of the sulphide pit. The fluid from the peritoneal cavity of the inoculated animals grew the anthrax bacillus on agar. The first field in the culture was cloudy and the bacillus was not isolated. Subsequent cultures, however, grew true bacilli of anthrax. It is believed that a gelatin culture will grow the bacillus primarily. The conclusions of this investigation were that the sodium sulphide bath does not kill the anthrax spores, but does affect them so that they become latent or dormant, and are revived into activity by the heat of the human body after inoculation. It was noticed frequently that the men inoculated while handling hides at this sulphide dip had the disease in a lighter form than men inoculated while handling dry hides. The practical lesson from these observations is to substitute wet handling for dry handling of hides.

Brass Poisoning.

The case of brass poisoning reported is typical of this class of occupational disease: —

> Man, forty-three years of age, employed in a brass foundry pouring molten brass as well as attending the furnace. This man, like many others affected by brass poisoning, had been employed at this work for many years. He had no chills until quite recently, when atmospheric conditions in the foundry became particularly bad because of a derangement of the blower system. During this period, covering several weeks, he had chills frequently, but "as these were very common among molders" he did not think it necessary to report the fact. On March 5, 1916, he developed a dry, persistent cough. Later in the night he had a severe chill, which was repeated twice during the night and also twice during the following day. These chills were followed by marked perspiration, and were accompanied with headache, vertigo, visual disturbances and marked conjunctivitis.

Benzol Poisoning.

Benzol or benzene is used extensively in the industries of this State, and has given rise to much ill health and has caused four deaths. It is an unstable and very volatile, colorless fluid with a heavy aromatic odor. It is a derivative of coal tar distillation, and is frequently confounded in literature with *benzine,* a petroleum derivative, with which it has many properties and uses in common. Benzol is decidedly more poisonous than benzine.

It contains many poisonous substances, such as hydrogen sulphide, toluene and bisulphide of carbon (often 50 per cent.). Much of the toxic effects noted is due to these substances. Poisoning by benzol depends upon individual susceptibility and immunity (natural or acquired), as well as upon the quantity and proportion of impurities in the fumes inhaled.

The principal uses of benzol (benzene) are: manufacture of colors and dyes; carbonizing motor gas and illuminating gas;

refining and dissolving fat and grease; lacquer (acid proof) colors and varnish work; rubber industry; as a cement in auto tire building; in anti-rust, anti-corrosive and rapid drying paints. It is also used in the manufacture of pharmaceutical preparations, as aspirin, antipyrine, etc., as well as in the preparation of perfumery scents. Lately benzol has been extensively used as a substitute for benzine and oil of turpentine, because of its great power in dissolving resin.

Benzol, like its homologues and other hydrocarbons of coal tar, has a specific affinity for the central nervous system and a general action on the protoplasm of the organic cell. The remarkable property possessed by benzol of reducing the number of leucocytes in the blood has given to it a place in medicine in the treatment of myelagenous leukæmia. Female workers, particularly at the age of puberty and at the menstrual period, are especially susceptible to benzol poisoning. Symptoms of benzol poisoning vary much with the mode of poisoning, *i.e.*, whether in the form of vapor through the respiratory organs, or by absorption through the skin or through the digestive tract.

The following cases reported to the State Board of Labor and Industries are typical of the symptoms and result of benzol toxæmia: —

1. *Acute Benzol Poisoning.*

Two steam fitters were employed in repairing pipes inside a benzol still that had been drawn off three days previously. These men worked together inside the still. This retort was 5 by 8 feet, and was entered by a manhole opening 11 by 15 inches. A stream of compressed air, under 60 pounds' pressure, was fed into the still by a 2-inch pipe while the men were engaged at this work.

One workman, thirty-five years of age, entered the still about 11 A.M. and worked until 12 noon. He and another workman, twenty-three years of age, entered the still at 12.30 P.M. At 1.15 P.M. the older man became greatly excited, laughing, singing, gesticulating and acting "as if he had gone crazy." He soon became unconscious and was lifted through the manhole by his fellow worker. It required twenty minutes to get his body through the opening of the retort. It was then discovered that the younger man was unconscious on the floor of the still. He was removed and all efforts to resuscitate him failed. No autopsy was held.

The older man was resuscitated by artificial respiration, oxygen inhalation, lung motor and stimulants. Several days later he was able to report for work.

2. *Acute Nitrobenzol Poisoning.*

A man, sixty-five years of age, employed as a teamster for a soap factory, on July 7, 1916, while delivering a 5-gallon flask of oil of mirbane (nitrobenzol), accidentally loosened the cork of the flask, spilling the chemical on his clothes. A fellow workman noticed his pale, sick appearance, and before he could reach him he had grown dizzy, nauseated, cyanotic about the lips, mentally confused, and was soon unconscious. Artificial respiration failed to resuscitate him and he was taken to the hospital. He soon developed Cheyne-Stokes respiration, slow weak pulse, blood pressure 90 systolic, 50 diastolic. Blood showed methæmoglobin, and later convulsion and coma developed, followed by death three and one-half hours after the accident. Autopsy findings, poisoning by nitrobenzol.

3. *Chronic Benzol Poisoning.*

In view of the little information available in textbooks on this subject, the five chronic cases of benzol poisoning (three fatal) reported in Massachusetts are given in detail. All of these cases occurred in the auto tire-building department of a rubber establishment in which benzol cement was used. The process was essentially as follows: the benzol was poured from a can which was rigged with a ball cork arrangement and a trigger handle, so that it was necessary to pull the trigger in order to get a flow of benzol from the can. The benzol was poured onto a cloth and wiped around the tire preparatory to vulcanizing. This process was repeated about every half hour, or approximately eighteen times in an eight-hour day.

Fatal Case. — A man, thirty-three years of age, had been employed in the rubber industry since 1907. On April 20, 1915, he was transferred to the tire-building department. He soon complained of severe headaches, often lasting two or three days at a time. In March, 1916, he noticed that he was spitting blood, especially after brushing his teeth. This condition of spongy bleeding gums was noticed almost daily, and later in March he noticed bluish green spots on his left thigh, followed in a few days by similar spots on his left arm. Soon similar spots appeared in rapid succession on various parts of the body. On May 3 he gave up work on account of extreme weakness and dyspnœa on slight exertion. On this date he had a severe nosebleed, followed by a similar attack on May 7, when he was admitted to the hospital.

Physical examination showed spongy, bleeding gums, pale mucous membrane of throat and conjunctiva, ulceration in posterior nares. Spleen not palpable, knee jerks present and equal, no Babinski, no ankle clonus.

Eyes react to light and to distance, no nystagmus. Breath, foul odor. Free bleeding from right nostril. Speculum examination showed bleeding point on septum about three-quarters inch back and near floor of nares. Patient conscious, slight tremor of head, no glandular enlargements, lungs normal, heart sounds weak, regular, no murmur, spleen not felt. Liver 2 centimeters below costal margin, no masses in abdomen, no spasm, no tenderness. Ecchymotic spots on skin, most marked on outer side of left arm near shoulder and on outer side of each leg. Family history and personal history good. No purpura nor hæmophilia in family. Pulse 124, weak, vertigo and visual disturbance. Hæmoglobin, 60 per cent.; leucocyte count, 5,000; red count, 2,288,000.[1]

Transfusion of 10 ounces of blood followed by uncontrollable epistaxis. Nosebleeds daily, severe and uncontrollable. Gums spongy and bleed on least irritation. Headache, vertigo, dizziness, restlessness, delirium, talkative, loss of power of arms and legs, coma, convulsions and death on May 18. Autopsy diagnosis, benzol poisoning.

Blood Record.

	May 7.	May 11.	May 12.	May 14.	May 16.
Hæmoglobin (per cent.),	60	45	40	40	35
Leucocyte count,	5,000	–	1,810	1,100	850
Red count,	2,288,000	–	2,184,000	2,720,000	1,616,000
Polymorphonucleus,	–	29	–	–	14
Large mononucleus,	–	14	–	–	20
Small mononucleus,	–	53	–	–	62
Eosinophiles,	–	2	–	–	2
Myelocytes,	–	2	–	–	2
Platelets,	–	–[2]	–	–	–[3]
Acromia,	–	Slight	–	–	Slight
Poikilocytosis,	–	Slight	–	–	Slight
Megaloblasts,	–	Few	–	–	Fair

Fatal Case. — A man, forty years of age, had worked in a rubber factory since 1905. On May 21, 1915, was transferred to the tire-building department. In the winter of 1915 noticed much loss of muscular power. Easily fatigued, dyspnœa on least exertion. He was not able to work continuously, was losing in weight, had repeated attacks of headache. In March, 1916, began to have bloody stools. April 1 noticed tendency to have nosebleeds and a constant cold in the head. About May 1 had his first severe nosebleed, which he had difficulty in controlling. Gave up work on account of loss of muscular power, dizziness and shortness of breath. Entered hospital May 3 on account of severe nosebleed.

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[1] The Board is indebted to St. Elizabeth's Hospital, Brighton, for the clinical records of these chronic benzol poisoning cases.

[2] Diminished.

[3] Much diminished.

Physical examination: Well developed and nourished, skin sallow, anæmic mucous membrane, ulceration and bleeding spot in nose. Gums spongy, marked ecchymotic areas over lower and upper extremities, some areas being so large as to suggest trauma. No rigidity of neck, no glandular enlargement, lungs, heart and abdomen negative. No nystagmus nor strabismus, disc lemon color, teeth in poor condition, gums spongy with blood oozing at junction of gums and teeth. Knee jerk present and equal on both sides. No ankle clonus, Babinski nor Oppenheim. No disturbance or sensation. Pulse 120; palpitation, vertigo, hæmoglobin 65 per cent., leucocyte count 10,000; red count 3,400,000; blood pressure 120 m.g.

Patient failed steadily. Nosebleeds frequent and more severe. Twitching of limbs and head. Paralysis, delirium, Cheyne-Stokes breathing, involuntary movements of bowels, coma. Death May 20. Autopsy diagnosis, poisoning by benzol.

Blood Record.

	May 3.	May 10.	May 12.	May 13.	May 16.
Hæmoglobin (per cent.),	65	45	45	45	40
Leucocyte count,	10,000	4,800	2,300	800	750
Red count,	3,400,000	1,872,000	1,632,000	1,552,000	1,742,000
Polymorphonucleus,	–	38	–	–	–
Large mononucleus,	–	10	–	–	54
Small mononucleus,	–	48	–	–	54
Eosinophiles,	–	3	–	–	5
Mast,	–	1	–	–	1

Fatal Case. — A man, thirty years of age, had worked in a rubber factory about two years (since 1914), in tire-building department. No history of nosebleed, purpura, no hæmophilia, either individual or family. Late in 1915 noticed some "red spots" on face and neck. These persisted for about three weeks. During the spring 1916 noticed that he was much weaker and not able to do his work so well as formerly. Had headaches and dizzy spells. On May 6, 1916, consulted a physician, who reported symptoms as follows: Pallor, general weakness, loss of weight, dyspnœa, pulse 100 to 110, palpitation, weakness of gait, headache, dizziness, tinnitus, low white and red count, dry cough. Man returned to work, but had to quit again on May 27. Returned to work again on June 12.

On July 6 had nosebleed from left nostril lasting six hours. The symptoms increased in severity: Pallor, muscular weakness, loss of weight, dyspnœa, weakness of gait, tinnitus and nosebleed. Brought to hospital on July 20 on account of severe uncontrollable bleeding from left nostril.

Physical examination: Pale, anæmic, mucous membrane pale. Patient conscious, pupils equal, mouth and teeth in good condition. Gums bleeding, lungs normal, heart rapid, pulse regular, systolic murmur at apex, spleen not palpable, liver 1 centimeter below costal margin, no spasm, no tremor, no tenderness. Brownish yellow stains and evidence of ecchymotic areas on anterior surface on both sides, knee jerks lively, equal on both sides. Patient grew worse daily, and on July 30 developed lobar pneumonia with œdema of lungs. Died August 2. Autopsy diagnosis, acute lobar pneumonia, œdema of lungs, anæmia, exhaustion, consequent on poisoning by benzol.

Blood Record.

	July 20.	July 23.	July 26.	July 28.	July 30.
Hæmoglobin (per cent.),	40	40	30	35	30
Leucocyte count,	2,000	2,100	2,200	1,840	1,600
Red count,	2,136,000	2,048,000	1,364,000	960,000	944,000
Polymorphonucleus,	29	–	30	–	–
Large mononucleus,	7	–	13	–	–
Small mononucleus,	62	–	55	–	–
Eosinophiles,	2	–	1	–	–
Masts,	Few	–	1	–	–
Platelets,	–[1]	–	–	–	–
Acromia,	Moderate	–	–	–	–
Poikilocytosis,	Moderate	–	–	–	–
Coagulation time,	–	18	–	–	–

[1] Diminished.

Man, twenty years old, employed in a rubber factory since February, 1915. His duties consisted in receiving tires after they had been cured, and applying to them a benzol cement. In March, 1916, he manifested symptoms of benzol poisoning, and in May reported to the hospital for asymmetry of face, which he ascribed to the extraction of a tooth. Blood examination showed a hæmoglobin of 75 per cent., leucocyte count of 6,000, red count 4,480,000. He had headache, nausea, general weakness.

Man, twenty-nine years old, employed for more than two years in automobile tire-building in which he applied benzol to the fabric. For past three months has had a papular eruption size of pin head on extensor and flexor surfaces of arms, feet, ears and neck. Later this eruption developed into blebs. Very itchy, and accompanied by fever. Stated that 16 or 18 men among the 120 employed in department had similar eruption. Disappeared on substituting naphtha.

A chemical examination of the benzol used by these men showed it to be free from impurities, and of the pure benzol grade. In one of the cases the presence of arseniuretted hydrogen in large quantities in the urine raised a doubt as to possible arsenic poisoning. This was traced, however, to treatment by Fowler's Solution, that the man was taking for anæmia. The use of the benzol as a cement at the factory, in the tire-building process, was discontinued and naphtha substituted. No further cases of benzol poisoning have been reported to the State Board of Labor and Industries since this change.

Rules and regulations for the prevention of industrial poisoning in the process of manufacture of benzene derivatives have been prepared by the State Board of Labor and Industries, and have been distributed widely in the industries where these compounds are used or manufactured.[1]

Caisson Disease.

During the year there were 15 cases of caisson disease reported among workmen employed in compressed air. Many of these cases are typical of this disease.

The following cases from the list bring out clearly some of the characteristics of the disease: —

Man, forty-six years of age, colored, employed as a laborer in the tunnel under construction in Boston, worked on March 8, 1916, on the shift from 11 P.M. to 7 A.M. He was working under 22 to 26 pounds' gauge pressure. At 7 A.M., the end of his shift, he came through the air-lock with 15 or 20 other men, and underwent decompression, lasting ten or eleven minutes. From the air-lock he went into the dry room and was furnished with hot coffee.

He complained of feeling sick, and was sent to the first-aid room. Here he became nauseated and vomited; was removed to the City Hospital. He stayed in the hospital twenty-four hours and returned to his home, where he was ill for several days. He stated that he had had the pains many times, but never so severely as to produce the symptoms experienced in this case, viz., dizziness, deafness and inability to walk. The pain was generally in the head. Any attempt to walk at any time during the week following brought on a fit of dizziness. This condition gradually cleared up, and the man was able to return to work.

In all probability this was a case of disturbance due to pressure in the ears.

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[1] Bulletin No. 11.

Man, twenty-seven years of age, engaged in compressed air work in tunnel as a concrete worker, was taken ill suddenly after coming from the tunnel. He suffered a great deal of pain; crepitus was distinctly felt under the skin in the pectoral muscles. Symptoms were: pallor, general weakness and bends, rapid pulse, headache, vertigo, ataxia, mental disturbance and much loss of power.

Man, thirty-two years of age, employed as an electrician in tunnel, where the pressure was 25½ pounds' gauge, was overcome with caisson disease after coming from the air-lock in which he had undergone decompression for twelve minutes. This man was able to return to his home, and had retired before an attack of the bends showed itself. He was awakened by severe pain and immediately arose, dressed himself and returned to the tunnel, where he underwent further decompression, lasting two hours. Persistent pain in the knee remained for some days after.

Man, twenty-five years of age, employed as a laborer in a tunnel, working under 30 pounds' gauge pressure, was attacked by bends on the seventh day after starting employment. He stayed but ten minutes in the air-lock for decompression. He experienced considerable pain in the right ear and in the chest, as well as in the knees and lower legs. This man had worked on the Erie tube in New York for more than a year on four-hour shifts, and had never had bends.

Man, twenty years of age, employed as an engineer, left work at 7 A.M. on October 18. He reached the down town shopping district, and while buying a pair of shoes was overcome by excruciating pains in the knees, stomach and chest. He became dizzy, and had shortness of breath. He had been working under a gauge pressure of 20 pounds. He was returned to the air-lock, where he was decompressed for thirty minutes. On leaving the air-lock he was overcome the second time. He was returned for further decompression, and stayed in the air-lock fifty minutes, after which he was taken to the hospital, still dizzy, weak and short of breath. Pain centered in the gastric region. He was discharged from the hospital, cured, three days later.

Man, thirty-five years of age, employed as a contractor in a tunnel under 20 pounds' gauge pressure. He was decompressed for eight minutes on leaving the tunnel. He was taken ill with pain in the ankles, knees and muscles of the back, and had nausea, coughing, with bloody expectoration, shortness of breath, palpitation, headache and vertigo.

Man, thirty-two years of age, colored, engaged as a laborer in a tunnel under 30 pounds' pressure, taken ill on his first day of work and after he had failed to observe the rules about staying in the air-lock for decompression. On reaching the surface he was overcome with nausea, headache, vertigo and severe pains in all joints, especially ankles. Pain in back and knees was so great that he presented a characteristic picture of the bends, which has given caisson disease this name.

The State Board of Labor and Industries has adopted Rules and Regulations governing work in compressed air, and all work of this character undertaken or carried on in this State is subject to these Rules and Regulations. No case of caisson disease has been reported since the adoption and the carrying out of these special rules.[1]

Lead Poisoning.

During the year there were 112 cases of lead poisoning reported to the Board.

These cases represent a great variety of occupations and industries.

The following cases, selected from the list, show the wide extent of industrial lead poisoning, and the great necessity for giving this factor most careful consideration in searching for the cause of many symptoms of diseases whose origin is often not clearly evident: —

Man, forty-two years of age, employed as a house painter for twenty-nine years. While engaged on an indoor contract consisting of oiling and touching up the woodwork, as well as painting walls and ceilings, he developed symptoms of lead poisoning, consisting of pallor, nausea, vomiting, colic, constipation, headache and neuralgia. He exhibited blue line on gums.

There had been considerable sandpapering of the previously painted walls, and this gave rise to much dust in the room where the men were working. Windows were not opened, as an effort was being made to hurry the drying. The workmen ate their luncheon in the room in which the painting was going on.

This man had never before experienced any symptoms of lead poisoning. He was ill eleven weeks.

Man, thirty-seven years of age, engaged as an interior decorator, complained of nausea and vomiting while at work during the summer months. Later in the fall, while engaged in jury duty, during which he had not worked at his trade for five weeks, he was seized suddenly with colic, constipation and vomiting, blue lines on gums, and blood showed red-cell stippling.

Man, thirty years of age, employed as a whitewasher and calciminer for more than three years, noticed that he was losing weight rapidly, dizzy at times, eyesight affected, and had considerable frontal headache. Recently the odors of fresh paint nauseated and distressed him. While engaged in painting blinds and sashes he was suddenly stricken with colic, and on physical examination was found to have blue line on gums, loss of power, wrist drop and blood showed stippling.

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[1] Bulletin No. 7.

Man, twenty-seven years of age, employed in a rubber factory as a "spreader" in the manufacture of fabric; the compound used contained litharge. No facilities existed for washing hands before eating. The man was taken ill with abdominal pain, and the stools gave a positive reaction of lead.

Man, forty-two years of age, employed in a steel and wire factory. His work consisted in placing steel springs in hot pots. These hot lead pans are hooded and connected with a stack which takes off the fumes and smoke and the crude oil used as fuel. The steel springs are allowed to stay in the lead bath about five minutes and are removed by a hook arrangement, when they are carried on to a steel runway, cooled and tested by means of hydraulic presses.

This man handled the cold springs as they were being tested. Two lead baths in this room are not connected with an exhaust system. The man's symptoms were: pallor, loss of weight, general weakness, nausea, colic, constipation and blue line on gums. Diagnosis of lead poisoning confirmed.

Man, twenty-nine years of age, employed in a steel and wire establishment as a "temperer of wire," developed lead poisoning, consisting of nausea and vomiting, colic, constipation, headache, pallor, general weakness, blue lines on gums, stippling of blood cells.

Man, sixty years of age, employed as a refiner in a metal foundry. His duties consisted of attending a melting furnace in which various scrap metals were refined. He developed blue line on gums, constipation and diarrhœa. Blood showed stippling of red cells. He had had three previous attacks of lead poisoning between 1908 and 1916.

Man, twenty-nine years of age, employed in the tube works in which brass pipes are emerged in a tin bath which consisted of about 100 pounds of tin and 210 pounds of lead. This process of nickeling brass pipes was carried out in a one-story building with little or no ventilation. The man's symptoms were: gradual loss of weight, general weakness, pallor, constipation, nausea, blue line on gums and headache. Diagnosis of lead poisoning confirmed.

Man, fifty-three years of age, employed as a farmer, developed lead poisoning. Symptoms were: pallor, general weakness, loss of weight, colic, constipation, blue line on gums. Development after twenty days' work at spraying trees with arsenate of lead. No precaution was taken for washing the hands before eating. Blood cells showed lead poisoning.

Man, twenty-six years of age, employed as a weaver in a textile factory, developed lead poisoning, confirmed by blood tests. The only source of lead poisoning, arsenate of lead sprayed on trees. History of having eaten berries picked in the neighborhood in which spraying with arsenate of lead was being done.

Man, thirty-two years of age, employed in an insecticide establishment as a packer, developed lead poisoning, which on investigation showed that he had been engaged in crushing lead mixed with sulphur. Typical symptoms of lead poisoning developed. Diagnosis confirmed.

Man, twenty-four years of age, employed in a shipbuilding establishment. His duties consisted principally in holding rivets in a coke forge until they were cherry red, which rivets were then driven into perforations in the steel plates of the ship. These plates are usually thickly coated on both sides with red paint. The hot rivets inserted into the painted perforations give rise to smoke and fumes, which are readily inhaled by the riveter, and also by the sledge holder, who stands on the opposite side of the plate and holds a heavy hammer on the ends of the red-hot rivet. This man complained for over three weeks of constant headache and ringing noises in the ear, also sharp shooting pains in the chest; was not able to sleep, and manifested considerable nervousness. He had marked weakness of muscles of the wrist and forearm, with marked loss of grip in his right hand. Later he developed severe pains in the ankles, knees and shoulders. Later, dizziness, unsteadiness in walking and ataxia developed. He had marked blue lines on gums, and blood showed typical stippling of lead poison.

Man, forty-four years of age, employed in shipbuilding establishment as a boiler maker. His duties consisted of drilling holes in boiler plates with a machine driven by air power, and occasionally by electric power. These plates, as well as the seams and rivets, are heavily painted with lead. He developed dyspepsia, diarrhœa, loss of weight, loss of power of the right wrist, and suffered repeated attacks of colic. The paint mixture used on these boilers consists of 3 dry pints of 94 per cent. of pure red lead to each 30-gallon keg of equal parts of linseed oil and turpentine. Stools and blood showed typical lead poisoning.

Man, thirty years of age, employed as a mixer in a rubber factory. This man worked on a milling machine which was not hooded or connected with an exhaust system. Air in the room was filled constantly with litharge dust. Man developed pallor, general weakness, cough, shortness of breath, blue line on gums and marked stippling of blood cells.

Man, thirty years of age, employed as a packer of litharge in a lead establishment, developed lead poisoning. Litharge is manufactured in the room in which this man worked, and although each employee is furnished with a respirator, none of the employees use them. Many prefer to use a handkerchief tied over the nose and mouth. Symptoms of lead poisoning consisted of constipation, some weakness of right grip, and loss of power of the extensor muscles, blue line on gums. Diagnosis of lead poisoning confirmed.

Man employed as a furnace man, caring for furnaces where pig lead is heated and converted into a powder of litharge; considerable dust in the atmosphere, especially when litharge is taken from the furnace and shoveled into wheelbarrows. Man refused to wear respirator. Symptoms developed in this case were blue line on gums, constipation, rapid pulse. Diagnosis confirmed.

Man, thirty-three years of age, employed in a chemical establishment as a laborer in packing arsenate of lead, and also as a tender of the ore-burning furnaces. Previous to this he was employed as a plumber's helper in cleaning out the acid vats, which are made of lead. He worked on both the sulphuric acid vats and the nitric acid vats. The product of this manufacture is made into insect powder, and consists principally of litharge mixed with from 36 to 40 per cent. nitric acid, after which it is filtered and packed. This man was exposed to the process of manufacture of insecticide powder. His symptoms were constipation, general weakness, loss of weight and blue line on gums. Diagnosis of lead poisoning confirmed.

Man, forty-five years of age, employed as a linotype operator in a printing establishment. In the room where this man worked were seven linotype machines, the lead pots of which were not hooded. Ventilation poor, and very poor facilities for washing hands before eating. Man's symptoms were colic, constipation, loss of appetite, blue line on gums. Diagnosis of lead poisoning confirmed.

Man, twenty-five years of age, employed in a printing establishment for more than thirteen years, especially as a typesetter and compositor, handling small lead type continuously. He developed eczema of the hands and arms, chronic constipation, colic, blue line on gums. Diagnosis of lead poisoning confirmed.

Man, forty-five years of age, employed as a typesetter for over ten years, handling type metal continuously. He had a constant habit of placing type between the lips. Did not observe any rules of cleanliness in washing hands before eating. First evidence of lead poisoning was severe pains in legs, which caused him to collapse, followed by colic and pains in knee joints. Not able to rise to a sitting position without considerable pain. He developed general weakness, disturbance of gait, tremor, blue line on gums. Diagnosis of lead poisoning confirmed.

Man, forty-four years of age, employed in photogravure department of a printing establishment as a finisher of lead blocks upon which zinc plates are mounted, developed obstinate constipation, poor appetite, pain in right hip, blue line on gums; lead found in stool and urine.

Man, twenty-two years of age, employed as an artist in a lithographing establishment, developed lead poisoning symptoms of pallor, general weakness, blue line on gums. This man's work as an artist consists of making sketches on posters, using a hair brush occasionally, and moistening the other brushes in his mouth very often. Stippling of red cells confirmed diagnosis of lead poisoning.

Fume and Gas Poisoning.

The importance of fume and gas poisoning as a cause of illness, incapacity and death in industrial life has loomed up prominently in this country during the past two years because of the increased number of establishments undertaking the manufacture of dyes and other coal-tar products, especially benzene compounds.

In addition to this activity in the industries there has been a wide expansion in the use of petroleum as a fuel for automobiles and for power engines, as well as for many industrial and domestic purposes. There is very little protection to working people against poisoning from impurities in these compounds. The nonodorous nature of some of the most deadly of these gases favors chronic poisoning by them to a degree not generally appreciated.

The list of the various gases and fumes met in nature and in the industries is a long one. All attempts to classify the various gases and fumes have been unsatisfactory. Some have an irritating effect on the mucous membrane and the skin; others affect chiefly the red blood cells and destroy their powers of carrying oxygen; while a third group have a special effect on the brain and the nervous system. A combination of two of these effects, and frequently of all of them, is the rule rather than the exception in cases of poisoning, inasmuch as the different groups are usually combined in the same compound.

The cases of fume and gas poisoning reported during the year 1916 number 18, with 5 deaths.

The list is much smaller than in the previous year because the number of cases of poisoning from benzene derivatives has been reduced greatly by the application of the Rules and Regulations put into operation by the State Board of Labor and Industries.[1]

CARBON MONOXIDE.

Seven cases with 1 death have been reported. The following description of some of the cases shows the deadly nature of this poison, as well as its mode of action under various conditions: —

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[1] Bulletin No. 11.

Man, sixty-four years of age, by occupation a tinsmith, was sent to an establishment where the fireproofing of a room was desired, and while he was engaged in covering the walls and ceiling with sheet iron he was overcome by carbon monoxide gas. He was rendered unconscious and fell from the staging where he was at work, and received a severe concussion of the brain; remained unconscious for several hours. The room in which he was at work was 24 by 24 by 30 feet. In this room there was a gas producer manufacturing carbon monoxide and hydrogen by means of incomplete combustion of pea coal. The gas formed was conducted through a pipe to the purifier, and from there to a motor where the gas is used as a motor fuel. Investigation showed that the joints at many places in this pipe were leaky, and a large quantity of gas accumulated in the room.

The workman complained of the odor of gas while he was at work on a staging near the ceiling. He was suddenly attacked with dizziness, vertigo, tremor, loss of muscular control, palpitation, slow pulse, nausea and unconsciousness, resulting in his fall. The period of muscular loss of power was still active eight months later.

There was no means of ventilation employed. Conditions were remedied by instituting a closer supervision over the pipes and joints conveying gas from this room.

Man, fifty years of age, employed as a melter in a manufacturing establishment making silver articles, was reported with symptoms of ataxia, disturbance of gait and marked argyria. These symptoms had been increasing in severity for more than a year. Investigation showed this man worked in the crucible room containing pots of molten metal. In this room the carbon monoxide is used in the annealing ovens. The presence of oxygen, with the extreme heat in these ovens, causes the silver to oxidize. Carbon monoxide is pumped into the ovens to control this oxidation. When the workmen open the doors considerable carbon monoxide escapes into the room.

Complaint of nausea and dizziness, especially in the winter time when the windows are closed, was very frequent. No hoods were provided to convey carbon monoxide outside the building.

Further investigation disclosed the fact that the men had no facilities for washing hands before eating. Considerable silver dust and other chemical compounds found their way into the system by this carelessness. Conditions were remedied by the installation of an adequate exhaust system and adequate washing facilities.

On admission to the hospital in June, 1916, it was found that the man had ataxia and disturbance of gait, right ankle clonus, some anæsthesia of feet, and marked argyria of hands, forearms, neck and face. Patient still under treatment for ataxia.

Man, fifty-two years of age, employed in annealing room of silver manufacturing establishment for five or six years, noticed considerable difficulty in locomotion. On March 14 was removed to the hospital.

Man's symptoms were headache, vertigo, nausea, conjunctivitis, loss of weight, constipation, rapid pulse and marked loss of muscular power in limbs. Diagnosis of carbon monoxide confirmed. Still under treatment.

Man employed as a "lock tender" on compressed air job, building tunnel under river. While off duty between shifts took a pail of hot coals into the air-lock room to keep himself warm. He was overcome by carbon monoxide gas, and during his unconsciousness was severely burned about the knees. He remained unconscious for several hours, and was finally resuscitated by means of oxygen, artificial stimulation and heat.

Man employed as a molder in a foundry was given the job of attending furnaces during the night, and on a very cold night closed all windows and means of ventilation. He was found unconscious in the morning. The room was heavily laden with the odor of gas. Resuscitation accomplished by means of oxygen, artificial respiration, heat and stimulants.

Fatal Case. — Man employed in a gas factory in cleaning the bottom of the purifying tanks in some unaccountable way removed the plug from the drip pipe, and in the darkness was unable to find it. He was overcome by the escaping gas, and found dead later by fellow workmen. Cause of death given as carbon monoxide poisoning

HYDROGEN SULPHIDE.

Two cases were reported during the year. Workmen employed in the manufacture of golden and crimson antimony powder used in the rubber industry were overcome by fumes during the mixing of the antimony with the sulphuric acid. These fumes were generally sulphuretted hydrogen.

The men were engaged in making repairs in a sulphuric acid tank, when they were suddenly overcome. Two men gave symptoms of dizziness, vertigo, nausea, tingling sensation in the throat, noise in the ears, and both lapsed into unconsciousness with convulsive movements of arms. Coma lasted several hours, followed by marked muscular weakness, incapacitating the men for several days.

Fatal Case. — Man engaged in cleaning sewer basin was noticed by fellow workmen to be acting queerly and showing hallucination. Fellow workmen went into the catch basin and attached a rope to the workman's body. In the attempt to pull the body through the manhole opening the rope broke. Workman, when finally removed to the surface, was unconscious and remained in a state of coma for many hours and all efforts to resuscitate him failed.

Nitrous Acid Gas.

Fatal Case. — On May 6, man, fifty-four years of age, employed as a carpenter, was sent to repair a small building in which the nitration of copper was carried on. This process was briefly as follows: 30 pounds of copper metal were put into porcelain jars containing 420 pounds of 30 per cent. nitric acid. This nitration was started usually on Friday afternoon, and the small building in which the process was carried on was locked up without an attendant. On Saturday afternoon 30 pounds of metal were placed into the jars, and the process allowed to proceed until Monday morning, when the batch of copper nitrate was removed to be used in another department of the establishment. The door of the building was broken open some time Saturday or Sunday, and considerable crude copper stolen. The carpenter was sent to repair the door.

After working a short time in the building he noticed irritation of the nose and throat, and considerable irritation of the bronchial tubes. He went into the open air, and cyanosis, nausea, cough, shortness of breath, pulse 160, headache, mental disturbance and unconsciousness developed. There was marked ulceration of the mucous membrane of the nose.

On May 11 paralysis of the right arm and leg developed. Paralysis continued to progress, and the man died May 16. Autopsy showed œdema of lungs, bronchopneumonia, clot on right side of brain with embolus at top of left motor area, punctate hemorrhage in corpus callosum, and a massive hemorrhage size of an egg in left parietal region. Diagnosis, nitric acid gas poison.

Fatal Case. — Man, forty-three years of age, metal worker for more than five years. He had lately been engaged in dipping metal into a mixture of nitric and sulphuric acid. For a number of months he had cramps in calves of legs while at work.

Early in July he was treated for gas poisoning, exhibiting the following symptoms: cyanosis, dermatitis of the arms, general weakness, loss of weight, acute arthritis, nausea, dyspepsia and constipation. Pulse 90. Later he developed tremor, twitching, mental disturbance, visual disturbance, conjunctivitis, tinnitus and progressive deafness. Died July 17. Autopsy findings, nitric acid gas poisoning.

Man, twenty-six years of age, colored, employed as a foreman in an ammunition factory, was employed in repairing leakage from pipes conveying nitrous acid gas from nitrator to the condenser in a picric acid plant. He exhibited nausea, cough, dyspnœa, pulse of 90, marked pharyngitis, headache, vertigo and mental disturbances.

Man, forty-one years of age, employed in making red dye in an aniline establishment in which there was considerable escape of nitric acid fumes, was overcome with dizziness, cyanosis, dyspnœa, general weakness, marked mental disturbance, headache and was unable to stand or walk. After suspension of work for some days and living in the open air all these symptoms disappeared. Favorable recovery reported.

Sulphur Dioxide.

Fatal Case. — Man, forty-two years of age, employed for over six months in a sodium bisulphate department of a chemical works as night foreman. On May 14 he was treated by the attending physician for cold. Worked as usual on next day, and on May 16 until 6.40 A.M. Went home apparently free from his cold, and at 3 P.M. the same day was suddenly attacked with violent spasmodic cough, dyspnœa and suffocation. He died within half an hour. Autopsy findings showed marked irritation of the respiratory track, œdema of lungs, marked congestion of the liver, spleen and kidneys. Bright red eruption on the elbows. In the heart there was a gelatinous substance not resembling the common post-mortem clot. Chemical analysis of organs showed absence of carbon monoxide, no cyanogen, and a slight amount of carbon dioxide.

Trinitrotoluene.

Three cases — 2 deaths — have been reported during the year from this gas.

Fatal Case. — Man, twenty-six years of age, employed as a laborer about the yard of a chemical works where nitrating of toluene was being done.

On Saturday worked from 6.30 A.M. to 5 P.M. Did not work on Sunday. Reported at 6.30 A.M. Monday, and soon requested leave of absence on account of nausea, vertigo and loss of power. Returned to his home at 7 o'clock in the morning. Fellow workmen visited him in the evening and noticed hallucinations, mental confusion, inability to talk, and had him removed to hospital, where he died at 11.30 P.M. the same day. Autopsy findings, death from trinitrotoluene gas.

Fatal Case. — Man, forty-three years of age, employed as a guard about a plant nitrating toluene since December, 1915. On Feb. 15, 1916, was transferred to the nitrating department. On the following day, while cleaning the inside of the denitrating tank, he was frequently compelled to go into the air for relief because of nausea, dizziness and blurred vision. He worked from 10 A.M. until 2 P.M., walked about 1 mile to an electric car, and rode 5 miles to his home. Early in the evening he was seized with vertigo, hallucinations, spasm, unconsciousness, and died at 2 o'clock in the morning. Autopsy findings, œdema of lungs, due to gas poisoning.

A marked characteristic of both of the foregoing cases was the delayed onset of fatal symptoms, and the long interval of apparent good health between the time of poisoning and the onset of serious symptoms.

This late manifestation of toxæmia from benzene derivatives is a characteristic factor in this group of industrial poisonings.

These cases also occurred in cold weather, during which there was much exposure after the onset of the first acute symptoms.

Most authors emphasize the necessity of safeguarding men who have been exposed to gases and fumes of this group of poisons against cold.

Both of the cases given above show the characteristic manifestations of red-cell destruction and secondary oxygen starvation, especially of the brain and nervous system. Post-mortem findings showed marked blood destruction and organ congestion.

Man, forty-three years of age, and fellow worker of the previous case just described, finished his work on February 16 at 2.30 P.M. He walked 3 miles to an electric car and rode 7 miles to his home. He was awakened suddenly next morning at 2 o'clock with dyspnœa, suffocation, chill, pain in left chest, marked cyanosis, dizziness and marked muscular prostration. He had a thick, sticky brownish expectoration, slight fever, cloudy urine, dark sticky dejections, crepitant rales at base of both lungs. Diagnosis, œdema of lungs, slow recovery.

Wood Alcohol.

The only case of wood alcohol reported was a man, twenty-four years of age, employed in a fiberloid establishment where wood alcohol was used as a solvent for the material being manufactured.

On September 9 man complained of headache, vertigo, irritation of the eyes and facial disturbance. He was able to go home. The vision became worse during the evening, and progressed rapidly to complete blindness in both eyes. Hospital diagnosis, primary optic atrophy due to wood alcohol poisoning.

Miscellaneous Cases.

Fatal Case, Tetanus. — Employee, sixty years of age, working on a wool-carding machine, was injured on March 30 while cleaning the machine when it was in motion. He tried to remove wool and dirt between two drums covered with pins used in combing wool, and received multiple lacerations of the hands. On April 7 he showed symptoms of tetanus. Removed to the hospital, and died at 9.20 P.M. on April 8. Autopsy findings, confirmed diagnosis of tetanus.

Man, forty years of age, employed as a wool cleaner in a woolen mill in which a naphtha-cleaning process is employed. This man was employed on kiers into which 10,000 pounds of wool was pumped through a manhole. The manhole is tightly clamped with a cover, making the kier an air-tight compartment.

Naphtha vapor is forced through the wool, acting as a solvent for greases and oils, this process taking about forty-five minutes. The kier is unloaded from the floor below, and the wool is thrown onto a continuous moving plate that conducts it to the carding department.

This man developed a severe dermatitis of the legs, which became septic and which developed into an erysipelas condition, incapacitating the man for work for several weeks. Diagnosis, septic dermatitis, occupational origin.

Analysis of Occupational Diseases reported

Date of Report.	Sex.	Age.	Diagnosis.	Occupation.	Kind of Establishment.
1916.					
March 8, . .	Male.	33	Anthrax.[1]	Leather worker.	Tannery.
March 13, . .	Male.	32	Anthrax.[1]	Longshoreman.	Wharf.
March 14, . .	Male.	35	Anthrax.	Laborer.	Tannery.
March 15, . .	Male.	19	Anthrax.	Beam house.	Tannery.
March 17, . .	Male.	22	Anthrax.	Flesher.	Tannery.
March 21, . .	Male.	24	Anthrax.	Weigher of hides.	Tannery.
March 21, . .	Male.	24	Anthrax.	Beam house.	Tannery.
March 24, . .	Male.	31	Anthrax.[1]	Tanner.	Tannery.
March 25, . .	Male.	30	Anthrax.	Weigher and selecter of hides.	Tannery.
March 26, . .	Male.	44	Anthrax.	Flesher.	Tannery (beam house).
April 10, . .	Male.	32	Anthrax.	Laborer.	Tannery.
April 10, . .	Male.	31	Anthrax.	Tannery teamster.	Tannery.
April 26, . .	Male.	21	Anthrax.	Beam house.	Tannery.
April 29, . .	Male.	41	Anthrax.	Tanner.	Tannery.
April 29, . .	Male.	52	Anthrax.	Flesher.	Tannery.
May 31, . .	Male.	52	Anthrax.	Flesher.	Tannery.
June 1, . .	Male.	21	Anthrax.	Mill hand in beam house.	Tannery.
June 9, .. .	Male.	56	Anthrax.[2]	Teamster.	General contractors.
June 16, . .	Male.	23	Anthrax.	Laborer in wool cellar.	Tannery.
June 30, . .	Male.	25	Anthrax.	Flesher.	Tannery.
August 11, .	Male.	–	Anthrax.	Currier.	Tannery.
August 27, .	Male.	21	Anthrax.	Sorter.	Tannery.
October 19, .	Male.	–	Anthrax.	Flesher.	Tannery.
November 22, .	Male.	–	Anthrax.	Sorter.	Tannery.
November 30, .	Male.	30	Anthrax.[2]	Flesher.	Tannery.
November 30, .	Male.	16	Anthrax.	Sweeper.	Carpet mill.
December 14, .	Male.	46	Anthrax.[1]	Flesher.	Tannery.
May 5, . .	Male.	40	Benzol.[1]	Tire maker.	Rubber manufacturing.
May 8, . .	Male.	33	Benzol.[1]	Tire coverer.	Rubber manufacturing.
May 18, . .	Male.	20	Benzol.	Treader of tires.	Rubber works.
May 29, . .	Male.	23	Benzol.[1]	Steam fitter.	T. N. T.
May 29, . .	Male.	27	Benzol.	Steam fitter.	T. N. T.
July 7, . .	Male.	65	Benzol.[1]	Teamster.	Soap and fertilizer.

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[1] Fatal.

[2] Diagnosis not confirmed.

to the State Board of Labor and Industries.

Nature of Work.	Length of Employment.	Symptoms.
Currier.	– –	Swelling of neck and face, extending down on chest wall.
Stevedore, carrying hides to and from ship.	2 weeks.	Dyspnœa (slight); some swelling of face and upper chest.
Carrying hides.	6 months.	Swelling and tenderness under left jaw; malaise.
Carrying hides.	1 month.	No pain or other symptoms.
Operates fleshing machine.	9 months ago.	Pallor; ulcerations of skin; headache.
Rawhide stamper.	3 years ago.	Slight sore throat on left side of neck; slight pain in upper left chest and arm; glandular enlargement in left axilla.
Handling hides.	10 days.	Pain and swelling on left side of neck; malaise.
– – –	– –	Swelling of right upper arm.
Weighing and selecting hides.	8 years.	Eruptions; general weakness; nausea.
Handling hides.	9 months ago.	Malignant pustule on left side of neck.
Handling hides.	2 years ago.	Malignant pustule.
Handling hides in yard.	2 years ago.	Ulcerations; headache; pulse 80.
Handles green hides from soaking pit. Does not carry on shoulder.	2 months.	Lesion on left cheek just above ramus of jaw near angle.
Works in tan room.	5 years.	Skin manifestations.
Operates fleshing machine.	28 years.	Malignant pustule.
Operates fleshing machine.	20 years.	Pustule, œdema of neck.
Mill hand in beam house.	6 months ago.	Malignant pustule.
– – –	– –	Lesion (initial) on dorsal aspect of left wrist.
Unties bundles of sheepskins, counts and places them in soaking pits. Later takes them out with a drag hook, piles on trucks for beam house.	– –	Lesion on right forearm below elbow; black crust, oozing serum; large vesicle about periphery surrounding red zone.
Laborer in beam house.	5 months.	Typical pustule outer aspect right hip about border of ileum. Spores and large bacilli found in smear.
Handles hides as they come from lime pits.	– –	Pallor; glandular enlargement (slight).
Sorting skins.	About 3 months.	– – –
Handling hides in beam house.	– –	Marked cellulitis of arm; pallor; eruptions; ulcerations; slightly atypical old pustule on left upper arm; umbilicated center with swollen œdematous border; several questionable bacilli in smear.
Sorts hides.	– –	Ulcerations; initial lesion in face.
Hide handler in beam house.	3 weeks.	Typical pustule on right jaw; lesions not confirmed as anthrax by bacteriological examination. Few suspicious organisms. Diagnosis not confirmed.
Sweeps weave room twice a day. Packs sweeping into bags.	5 weeks ago.	Suspicious organisms in smear.
– – –	– –	Cyanosis; other eruptions; general weakness; pulse 80.
Tire maker.	1 year.	Bloody stools; bleeding from nose.
Tire coverer.	1 year.	Ecchymoses different parts of body; poor appetite.
Tire treader.	1 year.	Bleeding time increased; hæmoglobin 75; w. c. 6,000; r. c. 4,480,000; high lymphocyte count.
Vat repairer.	1 day.	Pallor; vertigo; dyspnœa; delirium; death.
Vat repairer.	1 day.	Pallor; hallucination; dyspnœa; unconsciousness.
Teamster.	– –	Pallor; cyanosis; general weakness; nausea or vomiting; dyspnœa.

Analysis of Occupational Diseases reported to the

Date of Report.	Sex.	Age.	Diagnosis.	Occupation.	Kind of Establishment.
1916.					
August 2,	Male.	–	Benzol.[1]	Tire finisher.	Rubber.
December 4,	Male.	30	Benzol.	Helper in mill room.	Tire manufacturing.
November 16,	Male.	43	Brass poisoning.	Brass worker.	Brass foundry.
February 12,	Male.	23	Caisson disease.	Laborer in compressed air.	Tunnel.
February 17,	Male.	48	Caisson disease.	Laborer in compressed air.	Tunnel.
March 3,	Male.	38	Caisson disease.	Laborer in compressed air.	Tunnel.
March 9,	Male.	46	Caisson disease.	Laborer.	Tunnel.
March 12,	Male.	21	Caisson disease.	Laborer.	Tunnel.
March 29,	Male.	27	Caisson disease.	Concrete maker.	Tunnel.
March 30,	Male.	32	Caisson disease.	Electrician in caisson.	Tunnel.
April 6,	Male.	25	Caisson disease.	Shoveler.	Tunnel.
April 18,	Male.	30	Caisson disease.	Engineer.	Tunnel.
April 18,	Male.	35	Caisson disease.	Laborer in tunnel.	Subway.
June 13,	Male.	24	Caisson disease.	– –	– –
November 2,	Male.	32	Caisson disease.	Laborer in tunnel.	Tunnel.
November 9,	Male.	35	Caisson disease.	Compressed air worker.	Tunnel.
December 4,	Male.	38	Caisson disease.	Lock tender in caisson.	Tunnel.
December 27,	Male.	27	Caisson disease.	Caisson worker.	Subway.
January 18,	Male.	64	Carbon monoxide.	Tinsmith.	Factory.
January 18,	Male.	–	Carbon monoxide.	– –	Foundry.
February 5,	Male.	–	Carbon monoxide.	Lock tender.	Putting in sewer pipes under compressed air conditions.
February 7,	Male.	–	Carbon monoxide.	Shirt ironer.	Factory.
March 14,	Male.	52	Carbon monoxide.	Annealer.	Silver manufacturing.
June 15,	Male.	50	Carbon monoxide.	Melter.	Foundry.
November 11,	Male.	–	Carbon monoxide.[1]	Pumper.	Gas light company.
February 5,	Male.	–	Hydrogen sulphide.	– –	Factory.
August 14,	Male.	–	Hydrogen sulphide.[1]	– –	Manhole.
May 19,	Male.	54	Nitrous acid gas.[1]	Carpenter.	Print works.
July 12,	Male.	41	Nitrous acid gas.	Color worker.	Print works.

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[1] Fatal.

State Board of Labor and Industries — Continued.

Nature of Work.	Length of Employment.	Symptoms.
Cementing treads and rubbing finished product with chemical.	2 years.	Pallor; general weakness; loss of weight; dyspnœa; palpitation; headache; vertigo; disturbance of gait (weakness); tinnitus.
Helper in mill room.	8 months.	Pallor; cyanosis; nausea; dyspnœa; palpitation; headache.
Pours and carries molten brass; also tends furnace.	About 13 days.	Brass chills; general weakness; nausea or vomiting; constipation; cough; pulse 68; headache; vertigo; tremor; visual disturbance; conjunctivitis.
Building tunnel.	3 months.	Severe pains in both arms and shoulders.
Building tunnel.	3 months.	Severe pains in right arm and shoulder.
Building tunnel.	3 months.	Severe pains in extremities.
Building tunnel.	– –	Headache; vertigo; pulse 75.
Building tunnel.	– –	Cramp-like pains; stiffness and swelling of arms, legs and back.
Concrete work.	– –	Pallor; crepitus; ulcerations of skin or mucous membrance; general weakness; acute or chronic arthritis; colic; pulse rate; palpitation; headache; vertigo; ataxia; disturbance of gait; mental or emotional disturbances.
Electrician.	7 months.	Bends.
Subway construction.	18 days.	Blocked ear (right); chest pain; pain in knees and lower legs.
Driving engine which draws muck train.	– –	Severe pains in stomach and chest; slight pains in knees.
Pick and shovel.	15 days.	General weakness; nausea; cough and hemoptysis; palpitation; headache; vertigo; chills.
– – –	– –	Cramps in arms and legs.
Digging and shoveling.	2 days.	Marked pains in all joints, excepting ankles; worse in back and knees; was doubled up from pain in back.
Laborer in tunnel.	1 day.	– – –
Lock tender.	3 months.	Numbness and paresthesiæ of hands and feet; chills; dilation of abdomen.
Caisson worker.	– –	Pain in elbows and knees.
Fireproofing a room with sheet iron.	– –	Unconscious 1 to 2 hours; cyanosis; nausea; dyspepsia; pulse 76.
– – –	– –	Overcome by gas.
– – –	– –	Found unconscious.
Ironing shirts with gas irons.	– –	Gas poisoning.
Anneals.	– –	Trouble with locomotion; headache; vertigo; nausea; conjunctivitis; loss of weight; constipation; rapid pulse.
Tends melting pots. Sweeps floor of melting room.	– –	Staggering; marked pigmentation of exposed parts; some anæsthesia of feet.
Pumping to clear the condensation from bottom of tanks.	– –	Dead when found.
Making a powder used in rubber industry.	– –	Nausea and vomiting; severe headache, with a tickling in throat; vertigo; unconscious.
Cleaning out manhole.	– –	Found unconscious; never regained consciousness.
Ordinary occupation, keeping mill in repair.	11 years.	Cyanosis; mucous membrane ulceration; vomiting; diarrhœa; cough; dyspnœa; pulse 72 to 160; headache; paralysis right side; mental disturbance; delirium.
Working on Para red dye.	2 months.	Pallor; cyanosis; general weakness; dyspnœa; headache; disturbance of gait; not able to stand; mental or emotional disturbance.

Analysis of Occupational Diseases reported to the

Date of Report.	Sex.	Age.	Diagnosis.	Occupation.	Kind of Establishment.
1916.					
July 25, . .	Male.	43	Nitrous acid gas.[1]	Metal worker.	Metal works.
November 16, .	Male.	–	Nitrous acid gas.	– –	Picric acid plant.
May 16, . .	Male.	–	Sulphur dioxide.[1]	Foreman.	Chemical works.
February 17, .	Male.	73	T. N. T.	Laborer.	Chemical works.
February 17, .	Male.	43	T. N. T.[1]	Laborer.	Chemical manufacturing.
March 25, . .	Male.	–	T. N. T.[1]	Laborer.	Chemical works.
March 25, . .	Male.	–	T. N. T.[1]	Laborer.	Chemical works.
November 7, .	Male.	24	Wood alcohol.	Laborer.	Factory.
February 14, .	Male.	40	Septic ulcer of leg.	Wool cleaner.	Woolen mill.
April 7, . .	Male.	60	Tetanus.[1]	– –	Wool combing company.
January 6, . .	Male.	25	Lead poisoning.	– –	Structural iron work.
January 10, .	Male.	30	Lead poisoning.	– –	Paint factory.
January 18, .	Male.	26	Lead poisoning.	– –	Rubber works.
January 25, .	Male.	46	Lead poisoning.	– –	House painting.
January 27, .	Male.	50	Lead poisoning.	– –	Candy store.
January 31, .	Male.	28	Lead poisoning.	– –	Wire goods manufacturing.
February 7, .	Male.	33	Lead poisoning.	– –	Auto shop.
February 8, .	Male.	24	Lead poisoning.	– –	– –
March 11, . .	Male.	25	Lead poisoning.	– –	Junk shop.
March 11, . .	Male.	42	Lead poisoning.	– –	Iron, steel, copper, wire.
March 21, . .	Male.	–	Lead poisoning.	– –	Litharge manufacturing.
March 25, . .	Male.	32	Lead poisoning.	– –	Contracting painter.
March 28, . .	Male.	–	Lead poisoning.	– –	Painting.
April 1, . .	Male.	42	Lead poisoning.	– –	Painting.
April 3, . .	Male.	33	Lead poisoning.	– –	Chemical works.
April 8, . .	Male.	23	Lead poisoning.	– –	Foundry.
April 12, . .	Male.	30	Lead poisoning.	– –	Shipbuilding.
April 15, . .	Male.	49	Lead poisoning.	– –	Contractors.
April 15, . .	Male.	30	Lead poisoning.	– –	Lead works.

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[1] Fatal.

State Board of Labor and Industries — Continued.

Nature of Work.	Length of Employment.	Symptoms.
– – –	5 years.	Cyanosis; dermatitis on arms especially; general weakness; loss in weight; acute or chronic arthritis; nausea or vomiting; dyspepsia; constipation (moderate); tremor; mental or emotional disturbance; visual disturbance; conjunctivitis; tinnitus.
– – –	– –	– – –
– – –	– –	Autopsy found respiratory irritation; œdema of the lungs; both sides of heart filled with gelatinous substance; congestion of spleen and kidneys; bright red eruptions on elbows; cyanosis.
Laborer nitrating toluol.	1 year.	Expectoration; cyanosis; cough; dyspnœa; cloudy urine.
Laborer in T. N. T. plant.	2 days.	Œdema of lungs.
Laborer.	– –	– – –
Laborer.	– –	– – –
Pours wood alcohol on material from which combs and rubber collars are made.	– –	Patient has headache; vertigo; visual disturbance.
Naphtha cleaning of wool.	– –	Dermatitis; ulcerations of skin or mucous membrane.
– – –	– –	Pallor; headache; spasm of muscles of jaw, back and abdomen.
Assembles iron parts, fits them together and fits bolts for riveting.	5 years.	Blood shows stippling; pallor; general weakness; blue line on gums; cough; dyspnœa.
Mixing paint.	1 year.	Stippling in blood smear; pain in left arm and shoulder; pallor; general weakness; loss in weight; blue line on gums; colic.
Rubber worker (mixer).	4 years.	Stippling in blood smear; pallor; blue line on gums.
Inside and outside work, scraping, mixing, sandpapering.	– –	Blue line on gums; partial paralysis.
Candy maker and clerk at fruit store.	7 to 8 years.	Pallor; loss in weight; blue line on gums; nausea or vomiting; colic; constipation; epileptiform attacks; mental or emotional disturbance.
Painter of wire goods.	4 months.	Pallor; blue line on gums; colic; constipation; headache.
Puts on iron wheels (previously painted, but are dry when handled).	– –	Pallor; general weakness; loss in weight; acute or chronic arthritis; blue line on gums; cough.
House painter.	2 years.	Stippling in blood smear; blue line on gums; headache.
Sorting metal.	5 months.	Lead line on gums.
Testing springs coming from lead kettle.	10 to 12 years.	Pallor; general weakness; loss in weight; blue line on gums; nausea or vomiting; dyspepsia; colic; constipation.
Furnace man.	8 years.	Blue line on gums; nausea or vomiting; colic; constipation; pulse 78.
House painter.	9 years.	General weakness.
Inside painting.	2 years.	Pallor; general weakness; nausea; colic; constipation.
Painting.	7 years.	Pallor; headache; blue line on gums; nausea or vomiting; colic; constipation; neuritis or neuralgia.
Burns ore. Helps pack lead arsenate.	2 years.	General weakness; loss in weight; blue line on gums; constipation.
Paints castings.	1 year.	General weakness; nausea or vomiting; dyspepsia; colic; constipation; cough; headache; vertigo. Convulsion on April 5, 1916.
Helper in pipe shop.	– –	Some weakness of extensors left hand. No abdominal pain; no constipation.
Carpentry.	– –	Loss in weight; blue line on gums; continuous abdominal pain; no true colic.
Packs litharge; weighs and heads barrels of litharge; tends rollers of machine which feeds barrels.	– –	Some weakness of right grip and loss of power of extensors.

Analysis of Occupational Diseases reported to the

Date of Report.	Sex.	Age.	Diagnosis.	Occupation.	Kind of Establishment.
1916.					
April 15,	Male.	32	Lead poisoning.	– –	Bug powder manufacturing.
April 21,	Male.	27	Lead poisoning.	– –	Rubber works.
April 22,	Male.	33	Lead poisoning.	– –	Melting and refining works.
April 28,	Male.	50	Lead poisoning.	– –	House painting.
May 1,	Male.	23	Lead poisoning.	– –	Shipbuilding.
May 11,	Male.	–	Lead poisoning.	– –	Paper cups.
May 11,	Male.	50	Lead poisoning.	– –	Builders' finish.
May 17,	Male.	22	Lead poisoning.	– –	Lead, litharge.
May 31,	Male.	22	Lead poisoning.	– –	Lithographing.
May 31,	Male.	34	Lead poisoning.	– –	Interior decorating.
June 1,	Male.	30	Lead poisoning.	– –	Printing office.
June 3,	Male.	24	Lead poisoning.	– –	Painting.
June 7,	Male.	43	Lead poisoning.	– –	Newspaper publishing.
June 8,	Male.	29	Lead poisoning.	– –	Tube works.
June 8,	Male.	47	Lead poisoning.	– –	Rubber factory.
June 10,	Male.	30	Lead poisoning.	– –	House painting.
June 10,	Male.	32	Lead poisoning.	– –	Electric appliances.
June 12,	Male.	39	Lead poisoning.	– –	United States Navy Yard, Ordnance Department.
June 15,	Male.	25	Lead poisoning.	– –	Painting.
June 13,	Male.	44	Lead poisoning.	– –	Painting and contracting.
June 29,	Male.	22	Lead poisoning.	– –	Painting.
July 1,	Male.	29	Lead poisoning.	– –	Painting.
July 7,	Male.	46	Lead poisoning.	– –	United States Navy.
July 1,	Male.	47	Lead poisoning.	– –	Plumbing.
July 8,	Male.	29	Lead poisoning.	– –	Cordage works.
July 8,	Male.	58	Lead poisoning.	– –	Carpentry and building.
July 11,	Male.	–	Lead poisoning.	– –	Machine shop.
July 14,	Male.	43	Lead poisoning.	– –	Newspaper publishing.
July 17,	Male.	27	Lead poisoning.	– –	Carriage painting.
August 3,	Male.	–	Lead poisoning.	– –	Iron foundry.
August 3,	Male.	48	Lead poisoning.	– –	Carriage and auto manufacturing.
August 5,	Male.	26	Lead poisoning.	– –	Manufacturer of cotton goods.

State Board of Labor and Industries — Continued.

Nature of Work.	Length of Employment.	Symptoms.
Packer; works at crushing and screening machine.	– –	Blue line on gums; constipation.
Spreads rubber in manufacture of fabric.	– –	Abdominal pain; urine negative for lead; stool positive.
Cuts and melts scrap lead.	– –	General weakness; blue line on gums; colic.
Painter.	– –	Loss in weight; nausea or vomiting; colic; loss of appetite.
"Holder on." Holds sledge against rivets set hot in lead painted plates.	– –	Blue line on gums; pains in arms and legs.
Forming cups.	– –	Lead present in urine.
Painter.	5 years.	Pallor; general weakness; blue line on gums; dyspepsia; colic; constipation; headache; mental or emotional disturbances.
Packer's helper.	– –	Marked stippling of red cells. Loss of power of extensors of hands.
Artist.	– –	Stippling of red cells; nephritis.
Mixes lead paints.	– –	Weakness of grip and extensor; stippling of red cells.
Linotype setter.	– –	Occasional colic and indigestion; mental confusion; irrational at times.
Inside painter.	– –	Weakness of both grips; loss of power of extensor; leg pain; sacroiliac.
"Lumper"— stereotyping.	– –	Tingling and pain in arm; lead in stools.
Polishes tubes after immersion in lead bath.	– –	Pallor; general weakness; loss in weight; blue line on gums; nausea or vomiting; dyspepsia; constipation; headache.
Mixes rubber with litharge, whiting, etc.	– –	Pain in both elbows.
Mixes paint; paints; little sandpapering.	– –	Stippling red cells; pain in back; anus; abdomen; constipation.
Paints motors.	– –	Stippling; loss of power of thumb, first, second and third fingers on left hand.
Repairs guns.	– –	Pallor; ulcerations; general weakness; blue line on gums; nausea; dyspepsia; colic; constipation; tinnitus; vertigo; tremor; visual disturbance; dyspnœa; palpitation; headache.
Painter.	5 years.	Stippling in red cells; colic; constipation.
Painter (house).	26 years.	Lead in urine; chronic nephritis; œdema; general weakness; dyspnœa; palpitation.
Painter (house).	5 years.	Stippling in blood.
Painter (house).	7 years.	Stippling of red blood cells.
Chief gunner's mate. Painted building in Navy Yard; some chipping on gun mounts.	30 years.	Stippling of red cells.
Plumber.	– –	Lead present in urine.
Seeder.	– –	Blue line on gums; colic; constipation.
Painter.	– –	Pallor; brass chills; general weakness; loss in weight; nausea or vomiting; colic; constipation; pulse 110; palpitation; vertigo.
Painter.	8 to 9 years.	Blue line on gums; nausea or vomiting; colic; headache; pulse 100; severe epigastric pain.
Compositor.	– –	Pain; œdema; swelling, both great toes.
Painting, puttying.	– –	Blue line on gums; nausea or vomiting; colic; constipation; cramping pain across lower abdomen, with vomiting.
Painting; dips parts of machinery to coat them.	– –	Colic; constipation.
Paints auto bodies.	3 years.	Loss in weight; nausea or vomiting; colic.
Weaver.	Several years.	Blue line on gums (slight); neuritis.

Analysis of Occupational Diseases reported to the

Date of Report.	Sex.	Age.	Diagnosis.	Occupation.	Kind of Establishment.
1916.					
August 7,	Male.	28	Lead poisoning.	– –	Machine company.
August 25,	Male.	30	Lead poisoning.	– –	Rubber manufacturing.
August 26,	Male.	53	Lead poisoning.	– –	Lead wire works.
August 26,	Male.	–	Lead poisoning.	– –	Elevated Railway Company.
August 31,	Male.	25	Lead poisoning.	– –	Painting.
September 5,	Male.	26	Lead poisoning.	– –	Painting.
September 7,	Male.	24	Lead poisoning.	– –	Painting.
September 8,	Male.	60	Lead poisoning.	– –	Metal foundry.
September 9,	Male.	24	Lead poisoning.	– –	Shipbuilding.
September 12,	Male.	42	Lead poisoning.	– –	Battleship cold storage room.
September 12,	Male.	34	Lead poisoning.	– –	Rubber factory.
September 15,	Male.	53	Lead poisoning.	– –	Farm.
September 21,	Male.	28	Lead poisoning.	– –	– –
September 21,	Male.	30	Lead poisoning.	– –	General painting; sandpapering.
September 28,	Male.	35	Lead poisoning.	– –	Painting, Boston & Maine Railroad.
September 29,	Male.	45	Lead poisoning.	– –	Foundry.
September 29,	Male.	22	Lead poisoning.	– –	Ship-fitting (cold storage rooms on ships).
September 30,	Male.	24	Lead poisoning.	– –	House painting.
October 9,	Male.	37	Lead poisoning.	– –	Rubber factory.
October 10,	Male.	25	Lead poisoning.	– –	General work.
October 11,	Male.	33	Lead poisoning.	– –	– –
October 16,	Male.	44	Lead poisoning.	– –	Painting and carpentry.
October 21,	Male.	25	Lead poisoning.	– –	General painting.
October 25,	Male.	35	Lead poisoning.	– –	Paint shop.
October 30,	Male.	32	Lead poisoning.	– –	Carriage shop.
October 31,	Male.	25	Lead poisoning.	– –	Paint shop.
November 1,	Male.	24	Lead poisoning.	– –	Painting and varnishing.
November 5,	Male.	31	Lead poisoning.	– –	Painting.
November 6,	Male.	31	Lead poisoning.	– –	Painting.
November 8,	Male.	26	Lead poisoning.	– –	Painting; sandpapering.
November 9,	Male.	43	Lead poisoning.	– –	Painting.

State Board of Labor and Industries — Continued.

Nature of Work.	Length of Employment.	Symptoms.
Varnisher; sandpapers previous coat and then varnishes woodwork for spinning frames.	7 years.	Sense of fullness; occasional floating pains over body; lead in stool.
Compounds rubber.	7 years.	Weakness of extensors — left; pallor; blue line on gums; colic.
Puts pig iron in ovens and takes out.	10 years.	Weakness of grips; extensors of forearm also affected; blue line on gums.
Woodworker; works beside painter in car; works with wood coated with fresh paint.	7 years.	Pallor; general weakness; blue line on gums; nausea or vomiting; colic; constipation; headache; mental disturbance (or emotional).
House painter; some mixing and sandpapering.	- -	General weakness; blue line on gums; constipation.
House painter; painting, sandpapering.	11 years.	Loss of power, extensors of forearm.
Painter; sandpapering.	1 month.	Pallor; cyanosis; blue line on gums; colic; constipation.
Refiner; refining various metals.	30 years.	Stippling of red cells.
"Holder on." Holds sledge against rivets set in lead by air hammers.	1 year.	Blue line on gums; dyspepsia; pain in chest.
Putting linings on storage rooms on battleships (plumber).	6 months.	Colic; constipation; loss of nerve power extensors of wrist; lead in stool.
Calender operator adjoining mixing mill.	3 years.	Lead in stools; poor appetite.
General work; used much arsenate of lead.	4 years.	Stippling of red blood cells; pallor; general weakness; blue line on gums; colic; constipation.
Plumber; sheet lead work (cold storage on ships).	2 years.	Lead present in stool; loss of appetite; nausea or vomiting; colic; constipation.
House painting; sandpapering.	4 years.	Stippled cell; lead in urine and stools; loss of appetite; some loss of strength; colic; constipation.
Car painter.	10 years.	Mental condition does not seem typical of lead encephalopathy.
Melter.	10 years.	Pain in external condyle; loss of power of forearm; lead in stool.
Ship-fitter's helper.	15 months.	Loss of power right forearm; lead in urine and stool.
Painter.	5 years.	Some loss of power of extensor; blue line on gums; colic; constipation.
Rubber mixer.	- -	Stippling of blood; blue line on gums; nausea or vomiting; colic; diarrhœa.
Painter (house).	- -	Inequality of grips and extensor; loss of appetite; pallor; blue line on gums; constipation.
Chipper; cuts rivets with air machine.	- -	Lead present in stool; grip and extensor, right hand below normal; colic.
Painter; carpenter.	Long time.	Presence of sugar in urine; pallor; headache; vertigo; blue line on gums; colic; constipation; neuritis or neuralgia.
House painter.	4 years.	Blue line on gums; colic; pallor.
House painter; mixing; sandpapering.	4 years.	Pain in right shoulder, radiating down arm; blue line on gums; colic.
Paints carriages and autos; much sandpapering.	10 years.	Stippling of red cells; loss of appetite; pallor; vertigo; blue line on gums; colic; constipation.
House painter.	3 years.	Acute sore throat; extensor left wrist poor; pallor; blue line on gums.
Painter.	11 years.	Blue line on gums; colic; constipation.
Painter; builder; paper hanger.	3½ months.	Dermatitis; loss in weight; blue line on gums; colic; constipation; pulse 80; headache; vertigo; tremor (slight).
House painter.	10 years.	Slight weakness of wrists, right grip and extensor; lead in stool; colic; lead in urine and stool; pain in feet.
House painter.	14 years.	Loss of appetite; weakness of grip and extensor on right; general weakness; blue line on gums; colic; constipation.
Painter (house).	7 years.	Pain in kidney region; weakness wrist on right; urinary incontinence; blue line on gums; general weakness; colic; constipation.

Analysis of Occupational Diseases reported to the

Date of Report.	Sex.	Age.	Diagnosis.	Occupation.	Kind of Establishment.
1916.					
November 9, .	Male.	–	Lead poisoning.	– –	Bed manufacturing.
November 13, .	Male.	30	Lead poisoning.	– –	Fire escape making.
November 14, .	Male.	32	Lead poisoning.	– –	United States Navy Yard.
November 18, .	Male.	48	Lead poisoning.	– –	Dairy farm.
November 15, .	Male.	–	Lead poisoning.	– –	Building construction.
November 23, .	Male.	–	Lead poisoning.	– –	Plumbing.
November 24, .	Male.	–	Lead poisoning.	– –	Publishing house.
November 24, .	Male.	–	Lead poisoning.	– –	Newspaper publishing.
November 24, .	Male.	–	Lead poisoning.	– –	Contracting painter.
November 24, .	Male.	–	Lead poisoning.	– –	Shipbuilding.
November 25, .	Male.	–	Lead poisoning.	– –	Glazing; house painting.
November 25, .	Male.	55	Lead poisoning.	– –	House painting.
November 29, .	Male.	41	Lead poisoning.	– –	Painting.
December 1, .	Male.	27	Lead poisoning.	– –	Steel and wire manufacturing.
December 5, .	Male.	25	Lead poisoning.	– –	Publishing house.
December 6, .	Male.	31	Lead poisoning.	– –	Painting and paper hanging.
December 9, .	Male.	37	Lead poisoning.	– –	Painting.
December 11, .	Male.	45	Lead poisoning.	– –	Newspaper publishing.
December 11, .	Male.	30	Lead poisoning.	– –	General painting.
December 14, .	Male.	29	Lead poisoning.	– –	Steel and wire manufacturing.
December 16, .	Male.	35	Lead poisoning.	– –	Chemical.
December 21, .	Male.	19	Lead poisoning.	– –	Stocking mill.
December 22, .	Male.	59	Lead poisoning.	– –	House painting; sandpapering.
December 29, .	Male.	46	Lead poisoning.	– –	Painting.
December 30, .	Male.	24	Lead poisoning.	– –	Painting.
December 28, .	Male.	22	Lead poisoning.	– –	Shipbuilding.
December 29, .	Male.	40	Lead poisoning.	– –	Oil company.
December 31, .	Male.	24	Lead poisoning.	– –	– –
December 31, .	Male.	49	Lead poisoning.	– –	– –
December 31, .	Male.	31	Lead poisoning.	– –	Rubber factory.

State Board of Labor and Industries — Concluded.

Nature of Work.	Length of Employment.	Symptoms.
Painter of beds.	6 years.	Lead in stools; extensor of wrist poor; pain in back; general weakness; colic.
Iron worker.	13 years.	Extensors a little weak (forearm); sense of heaviness in arms and shoulders; blue line on gums; colic.
Air riveter; uses pneumatic riveting machine.	19 years.	Weakness of left forearm; blue line on gums; colic.
Farm.	5 years.	Failing in health; pallor; general weakness; loss in weight; acute arthritis; blue line on gums; nausea or vomiting; dyspepsia; colic; constipation; cough; tremor.
Priming; handles wet frames.	11 years.	Paint in stool and urine; stippling of red cells; anæmia.
Plumber; handles considerable lead.	19 years.	Plumbism; asthma; blue line on gums; colic.
Typesetter; compositor.	11 years.	Pallor; general weakness; blue line on gums; constipation; pulse rate; vertigo; disturbance of gait; tremor; visual disturbance; mental or emotional disturbance.
Finisher in photo-engraving department; handles lead blocks upon which zinc plates are mounted.	26 years.	Lead in stool and urine; appetite poor; pain in right flank.
House painter; paint remover; sandpaperer.	21 years.	Pallor; blue line on gums; cough.
Boiler maker; handles lots of red lead.	21 years.	Loss of appetite; lead in stools; dyspepsia; colic; loss of power right wrist.
Glazier; painter.	21 years.	Appetite poor; lead in stool and urine; colic; constipation; hæmorrhoids.
House painter.	31 years.	Pain and weakness of muscles of arms; poor color; blue line on gums; constipation; neuritis.
House painter.	29 years.	Weakness of grip and extensor on right; blue line on gums; constipation.
Furnace man in painting room.	4 months.	Blue line on gums; stippling of blood cells; hæmoglobin 70 per cent. plus.
Setting up type by hand and operating presses.	13 years.	Diagnosis, eczema, caused by handling lead; chronic constipation.
Painter; paper hanger.	10 years.	Pain in right thigh; grips only fair; gastro-intestinal symptoms.
House painter.	8 years.	Blue line on gums; colic; constipation.
Linotype operator.	25 years.	Loss of appetite; blue line on gums; colic; constipation.
House painter.	- -	Loss of power right wrist; blue line on gums.
Temperer of wire.	1 month.	Stippling of blood cells; pallor; general weakness; blue line on gums; nausea or vomiting; colic; constipation.
Plumber's helper; assists in preparing sheet lead for pipe installation.	2 years.	Sense of heaviness; lead in stool and urine.
Carries bundles (boxes) from box factory to adjoining room.	4 months.	Marked stippling of blood; paint in stool; colic; constipation.
Painter.	6 years.	Colic; constipation; appetite poor; weakness of right wrist; paint in stool.
House and outside painting; mixing, scraping, sandpapering.	- -	Pallor; blue line on gums; colic; constipation.
Inside and outside painter; scraping; sandpapering.	4 years.	Pain in stomach; stippling in blood smear; pallor; blue line on gums; constipation.
Heater boy; heats rivets.	2 years.	Appetite poor for two months; grips are good, though left seems less than right; extensor less on left than right; right-handed, but left arm may be more powerful owing to former use on bellows; constipation; colic; blue line on gums.
Painting.	20 years.	Blue line on gums; colic.
Painter.	- -	- - -
Painter.	- -	- - -
Mixer; operates milling.	1 year.	Stippling in blood smear; other symptoms having to do with pleurisy; pallor; general weakness; blue line on gums; cough; dyspnœa.

Recapitulation of Occupational Diseases.

Diseases.	Number reported.	Number of Deaths.
Anthrax,	27	4
Benzol poisoning,	8	5
Brass poisoning,	1	-
Caisson disease,	15	-
Fume and gas poisoning: —		
Carbon monoxide,	7	1
Hydrogen sulphide,	1	1
Nitrous acid gas,	4	2
Sulphur dioxide,	1	1
Trinitrotoluene,	3	2
Wood alcohol,	1	-
Lead poisoning,	112	-
Miscellaneous,	2	1
Total,	182	17

Respectfully submitted,

THOMAS F. HARRINGTON, M.D.,
Medical Deputy Commissioner.

APPENDICES.

APPENDIX A.

EXPENDITURES FOR THE YEAR ENDING NOV. 30, 1916.

Salaries of members of the Board,	$5,500 00
Salaries of Commissioner of Labor and deputies,	13,500 00
Salaries of inspectors and investigators,	37,413 82
Salaries of counsel, chief clerk, stenographers and other office employees,	17,032 72
Traveling expenses,	7,937 12
Rent and care of offices,	8,278 39
Contingent expenses, including printing, books, postage, stationery, office supplies, typewriters, telephone and sundries,	11,223 40
Total,	$100,885 45

APPENDIX B.

ESTIMATE FOR APPROPRIATION FOR THE YEAR ENDING NOV. 30, 1917.

Salaries of members of the Board,		$5,500 00
Salaries of Commissioner of Labor and deputies,		13,500 00
Salaries of inspectors,		40,000 00
Salaries of expert investigators,		7,100 00
Salary of counsel,		3,500 00
Clerical and other assistants,		18,274 00
Traveling expenses,		12,000 00
Rent and care of offices,		9,000 00
Contingent: —		
Books, maps, etc.,	$500 00	
Expressage,	300 00	
Postage,	1,600 00	
Printing: —		
Annual report,	1,000 00	
Other reports,	3,000 00	
Office forms,	8,000 00	
Stationery and office supplies,	4,000 00	
Typewriter machines,	1,000 00	
Other machines,	300 00	
Telephone and telegraph,	2,000 00	
Other expenses,	1,000 00	
		22,700 00
Total,		$131,574 00

APPENDIX C.

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED AND THE NUMBER OF CERTIFICATES ISSUED UNDER THE PROVISIONS OF ACTS OF 1913, CHAPTER 779, AND GENERAL ACTS OF 1916, CHAPTERS 66 AND 95, FROM JANUARY, 1916, TO DEC. 31, 1916, INCLUSIVE.

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Abington,	114	6	31	–	–	167	6	42	–	–
Acton,	11	4	4	–	–	12	4	4	–	–
Acushnet,	72	13	58	1	–	109	57	181	1	–
Adams,	524	11	342	3	–	721	12	457	3	–
Agawam,	45	9	82	5	–	97	11	176	5	–
Alford,	–	–	–	–	–	–	–	–	–	–
Amesbury,	289	7	72	–	–	443	11	120	–	7
Amherst,	124	5	–	5	6	142	5	–	5	6
Andover,	146	2	136	–	–	214	–	209	–	–
Arlington,	255	1	58	–	–	349	1	81	–	–
Ashburnham,	14	2	9	–	–	20	2	11	–	–
Ashby,	3	–	–	–	–	3	–	–	–	–
Ashfield,	–	–	1	–	–	–	–	1	–	–
Ashland,	68	–	29	–	–	91	–	33	–	–
Athol,	326	14	171	1	–	448	19	267	1	–
Attleboro,	493	23	233	1	–	1,052	73	689	1	–
Auburn,	123	3	84	–	–	189	3	132	–	–
Avon,	104	–	17	2	–	164	–	38	2	–
Ayer,	48	–	12	–	1	59	–	19	–	1
Barnstable,	2	1	12	–	–	4	1	14	–	–
Barre,	23	8	23	–	–	23	8	24	–	–
Becket,	11	–	7	–	–	12	–	7	–	–
Bedford,	5	–	–	–	–	5	–	–	–	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Belchertown,	10	–	8	–	–	10	–	8	–	–
Bellingham,	13	1	7	–	–	18	1	8	–	–
Belmont,	137	2	17	–	–	177	3	21	–	–
Berkley,	12	–	6	–	–	16	–	8	–	–
Berlin,	7	–	2	–	–	10	–	2	–	–
Bernardston,	3	–	1	–	–	3	–	1	–	–
Beverly,	562	26	173	8	10	1,244	57	313	8	10
Billerica,	122	–	117	2	3	173	–	168	2	3
Blackstone,	60	5	58	1	7	53	5	54	1	7
Blandford,	–	–	–	–	1	–	–	–	–	1
Bolton,	5	–	3	–	–	6	–	4	–	–
Boston,	11,971	611	7,086	2,548	–	36,391	1,902	14,647	2,988	–
Bourne,	2	–	2	–	–	2	–	2	–	–
Boxborough,	–	–	1	–	–	–	–	1	–	–
Boxford,	–	–	–	–	–	–	–	–	–	–
Boylston,	23	1	5	–	–	27	2	7	–	–
Braintree,	192	2	85	3	–	203	2	101	3	–
Brewster,	–	–	–	–	–	–	–	–	–	–
Bridgewater,	198	47	71	–	–	250	57	89	–	–
Brimfield,	2	–	–	–	–	2	–	–	–	–
Brockton,	–	244	421	–	–	4,790	267	1,188	–	–
Brookfield,	67	–	31	–	–	67	–	31	–	–
Brookline,	259	–	68	–	–	590	–	85	–	–
Buckland,	24	–	8	–	–	24	–	8	–	–
Burlington,	8	–	1	–	–	9	–	1	–	–
Cambridge,	3,793	251	1,420	19	–	6,728	415	2,315	19	–
Canton,	125	28	71	–	–	187	36	123	–	–
Carlisle,	3	–	–	–	–	4	–	–	–	–
Carver,	–	–	–	–	–	–	–	–	–	–
Charlemont,	6	–	3	–	–	6	–	3	–	–
Charlton,	33	–	26	2	–	38	–	29	2	–
Chatham,	2	–	–	–	1	2	–	–	–	1

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Chelmsford, . .	275	2	150	–	–	209	1	100	–	–
Chelsea, . . .	1,514	190	431	11	–	2,873	417	679	11	–
Cheshire, . .	28	–	12	–	–	32	–	14	–	–
Chester, . . .	32	–	–	–	–	39	–	6	–	–
Chesterfield, . .	–	–	2	–	–	–	–	2	–	–
Chicopee, . .	1,184	192	698	19	–	2,248	261	973	21	–
Chilmark, . .	–	–	–	–	–	–	–	–	–	–
Clarksburg, . .	17	–	19	–	–	21	–	10	–	–
Clinton, . . .	522	49	286	2	–	579	54	317	2	–
Cohasset, . .	1	–	1	–	–	4	–	4	–	–
Colrain, . . .	23	2	20	–	–	30	4	36	–	–
Concord, . .	83	1	40	–	–	107	1	44	–	–
Conway, . .	19	–	10	–	–	20	–	10	–	–
Cummington, .	–	–	1	–	–	–	–	1	–	–
Dalton, . . .	124	–	16	9	–	145	–	17	10	–
Dana, . . .	1	–	1	–	–	1	–	1	–	–
Danvers, . .	–	–	–	–	–	–	–	–	–	–
Dartmouth, . .	109	20	77	1	–	167	42	101	1	–
Dedham, . .	227	4	112	1	–	316	4	154	1	–
Deerfield, . .	27	–	21	–	2	28	–	23	–	2
Dennis, . . .	–	–	–	–	–	–	–	–	–	–
Dighton, . .	79	1	11	–	–	99	1	15	–	–
Douglas, . .	51	9	49	2	–	–	–	–	–	–
Dover, . . .	7	–	–	1	–	8	–	–	–	–
Dracut, . . .	165	6	55	1	–	221	6	74	1	–
Dudley, . . .	131	39	107	2	–	203	39	193	1	–
Dunstable, . .	–	–	–	–	–	–	–	–	–	–
Duxbury, . .	3	–	–	–	–	3	–	–	–	–
East Bridgewater, .	109	3	34	–	–	140	3	36	–	–
East Longmeadow,	63	6	30	–	–	99	14	44	–	–
Eastham, . .	–	–	–	–	–	–	–	–	–	–
Easton, . . .	161	8	46	–	–	273	8	62	–	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Easthampton,	684	185	244	2	–	919	225	325	2	–
Edgartown,	–	–	7	–	3	–	–	7	–	3
Egremont,	–	–	–	–	–	–	–	–	–	–
Enfield,	13	–	13	–	–	13	–	13	–	–
Erving,	41	1	17	1	–	49	1	17	1	2
Essex,	13	–	6	–	–	15	–	8	–	–
Everett,	715	9	360	1	–	1,582	20	753	1	–
Fairhaven,	201	23	62	14	12	444	62	278	24	36
Fall River,	3,950	683	2,871	34	–	6,370	1,189	5,214	51	–
Falmouth,	4	–	13	–	7	5	–	14	–	8
Fitchburg,	393	202	592	5	–	1,424	109	739	–	–
Florida,	4	–	–	–	–	4	–	–	–	–
Foxborough,	35	–	81	–	–	49	–	106	–	–
Framingham,	322	26	113	–	–	384	36	151	–	–
Franklin,	138	28	61	2	–	197	42	86	2	–
Freetown,	14	4	9	–	–	15	4	11	–	–
Gardner,	401	102	250	3	–	460	108	298	3	–
Gay Head,	–	–	–	–	–	–	–	–	–	–
Georgetown,	75	1	39	1	–	122	1	75	1	–
Gill,	–	–	–	–	–	–	–	–	–	–
Gloucester,	846	27	213	179	–	1,041	38	283	179	–
Goshen,	–	–	1	–	–	–	–	1	–	–
Gosnold,	–	–	–	–	–	–	–	–	–	–
Grafton,	139	6	41	7	–	154	6	53	7	–
Granby,	1	–	6	–	–	2	–	4	–	–
Granville,	–	–	2	–	–	–	–	6	–	–
Great Barrington,	81	6	48	–	–	85	6	50	–	–
Greenfield,	369	4	109	–	–	694	7	198	–	–
Greenwich,	–	–	–	–	–	–	–	–	–	–
Groton,	–	–	–	–	–	28	–	4	–	–
Groveland,	108	–	34	–	–	196	–	53	–	–
Hadley,	14	3	5	–	–	18	3	5	–	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

Name of City or Town.	Number of Persons issued Certificates.					Number of Certificates issued.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational. (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Halifax, . . .	–	–	–	–	–	–	–	–	–	–
Hamilton, . .	43	–	10	–	–	51	–	13	–	–
Hampden, . .	–	–	9	–	–	–	–	9	–	–
Hancock, . .	21	–	7	–	–	21	–	7	–	–
Hanover, . .	60	–	18	3	–	81	–	26	3	–
Hanson, . . .	50	–	13	2	–	73	–	31	2	–
Hardwick, . .	53	5	48	–	–	53	5	48	–	–
Harvard, . .	–	–	–	–	–	–	–	–	–	–
Harwich, . .	1	–	5	–	1	1	–	5	–	1
Hatfield, . .	8	1	4	–	–	8	1	4	–	–
Haverhill, . .	2,951	262	621	–	–	5,228	285	1,048	–	–
Hawley, . . .	–	–	–	–	–	–	–	–	–	–
Heath, . . .	–	–	–	–	–	–	–	–	–	–
Hingham, . .	58	–	8	–	4	68	–	12	–	4
Hinsdale, . .	41	–	16	–	1	53	–	20	–	1
Holbrook, . .	94	–	24	–	–	134	–	37	–	–
Holden, . . .	49	1	28	–	–	59	1	37	–	–
Holland, . .	–	–	–	–	–	–	–	–	–	–
Holliston, . .	62	5	31	6	–	95	5	39	6	–
Holyoke, . .	2,569	207	1,265	10	–	4,106	287	2,149	10	–
Hopedale, . .	88	1	41	2	–	110	1	51	2	–
Hopkinton, . .	81	–	36	–	–	108	–	42	–	–
Hubbardston, .	3	–	4	–	–	4	–	4	–	–
Hudson, . .	–	–	–	–	–	292	14	173	–	–
Hull, . . .	–	–	12	–	–	–	–	12	–	–
Huntington, . .	22	–	8	–	–	22	–	–	–	8
Ipswich, . . .	136	69	73	–	–	170	84	94	–	–
Kingston, . .	63	4	24	–	–	66	5	25	–	–
Lakeville, . .	–	–	–	–	–	–	–	–	–	–
Lancaster, . .	59	–	34	–	–	66	–	46	–	–
Lanesborough, .	23	–	8	–	–	27	–	8	–	–
Lawrence, . .	3,330	527	2,162	166	–	6,327	933	3,832	187	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

Name of City or Town.	Number of Persons issued Certificates.					Number of Certificates issued.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Lee, . . .	75	25	100	35	15	80	30	110	40	20
Leicester, . .	136	5	61	1	14	176	5	83	1	14
Lenox, . . .	23	–	9	–	–	23	–	9	–	–
Leominster, . .	567	85	385	9	–	941	110	670	10	–
Leverett, . .	2	–	2	–	–	2	–	2	–	2
Lexington, . .	57	–	9	–	–	70	–	10	–	–
Leyden, . . .	1	–	–	–	–	1	–	–	–	–
Lincoln, . . .	–	–	–	–	–	8	–	–	–	–
Littleton, . .	5	–	5	–	–	6	–	5	–	–
Longmeadow, .	–	–	31	–	–	–	–	31	–	–
Lowell, . . .	1,158	381	1,945	72	–	6,163	704	3,550	94	–
Ludlow, . . .	378	167	156	10	–	527	202	232	10	–
Lunenburg, . .	13	–	6	–	–	30	–	7	–	–
Lynn, . . .	–	–	–	–	–	5,154	235	1,143	5	–
Lynnfield, . .	6	–	3	–	–	8	–	3	–	–
Malden, . . .	990	9	623	18	–	2,750	25	896	25	–
Manchester, . .	25	–	9	17	–	38	–	9	17	–
Mansfield, . .	124	5	42	–	–	171	7	60	–	–
Marblehead, . .	17	–	130	–	–	25	–	161	–	–
Marion, . . .	5	3	–	–	–	–	–	–	–	–
Marlborough, . .	904	40	412	–	–	1,513	46	677	–	–
Marshfield, . .	3	–	–	–	–	3	–	–	–	–
Mashpee, . .	–	–	–	–	–	–	–	–	–	–
Mattapoisett, . .	–	–	–	–	–	–	–	–	–	–
Maynard, . .	110	25	50	10	–	162	27	70	10	–
Medfield, . .	39	–	4	1	–	39	–	4	1	–
Medford, . .	676	4	178	–	–	950	4	263	–	–
Medway, . .	52	1	29	4	–	74	1	37	4	–
Melrose, . . .	275	–	50	–	–	464	–	111	–	–
Mendon, . .	14	1	5	–	–	19	1	6	–	–
Merrimac, . .	59	–	19	–	–	68	1	25	–	–
Methuen, . .	614	34	289	3	6	1,240	85	724	3	7

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Middleborough, .	300	14	150	–	–	402	14	187	–	–
Middlefield, . .	–	–	–	–	–	–	–	–	–	–
Middleton, . .	–	–	21	–	–	–	–	24	–	–
Milford, . . .	218	20	44	–	–	–	–	–	–	–
Millbury, . .	182	9	121	–	–	265	9	169	–	–
Millis, . . .	39	–	40	2	–	40	–	40	2	–
Milton, . . .	109	–	17	–	–	135	–	20	–	–
Monroe, . . .	3	1	1	–	–	3	2	1	–	–
Monson, . . .	74	–	37	–	–	93	–	53	–	–
Montague, . .	102	10	43	4	20	150	10	49	4	20
Monterey, . .	6	2	10	4	8	8	3	12	15	9
Montgomery, . .	21	–	–	–	–	1	–	–	–	–
Mount Washington,	–	–	–	–	–	–	–	–	–	–
Nahant, . . .	31	–	13	3	–	–	–	–	–	–
Nantucket, . .	14	–	18	32	–	14	–	18	32	–
Natick, . . .	153	15	63	6	–	177	15	68	6	–
Needham, . .	154	12	50	–	–	185	12	62	–	–
New Ashford, .	–	–	–	–	–	–	–	–	–	–
New Bedford, .	732	597	1,551	200	135	6,531	1,883	4,139	200	135
New Braintree, .	–	–	–	–	–	–	–	–	–	–
New Marlborough,	2	–	–	–	–	2	–	–	–	–
New Salem, . .	1	–	–	–	–	1	–	–	–	–
Newbury, . .	29	–	19	–	–	68	1	25	–	–
Newburyport, .	1,500	71	130	3	–	3,000	298	768	3	–
Newton, . .	966	65	293	–	–	1,510	98	383	–	–
Norfolk, . .	21	–	3	–	–	21	–	3	–	–
North Adams, .	429	59	488	1	–	838	87	925	1	–
North Andover, .	236	5	106	10	5	346	6	143	12	5
North Attleborough,	179	5	125	–	–	228	8	221	–	–
North Brookfield, .	93	–	48	–	–	93	–	48	–	16
North Reading, .	12	–	7	–	–	18	–	11	–	–
Northampton, .	609	44	342	1	7	828	53	482	1	7

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

Name of City or Town.	Number of Persons issued Certificates.					Number of Certificates issued.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Northborough, .	16	–	9	–	–	20	–	12	–	–
Northbridge, . .	505	44	229	52	–	602	46	301	52	–
Northfield, . .	8	–	2	–	3	8	–	2	–	3
Norton, . .	16	5	30	13	5	23	6	47	13	5
Norwell, . .	13	–	3	–	–	13	–	3	–	–
Norwood, . .	315	25	75	–	–	380	30	90	–	–
Oak Bluffs, . .	2	–	3	–	–	2	–	3	–	–
Oakham, . .	1	–	2	–	–	1	–	3	–	–
Orange, . . .	115	1	35	–	–	123	1	35	–	–
Orleans, . . .	3	–	2	2	–	3	–	2	2	–
Otis, . . .	8	3	13	6	10	10	5	14	13	5
Oxford, . . .	87	7	49	–	–	99	7	61	–	–
Palmer, . . .	252	115	195	1	–	410	198	314	1	–
Paxton, . . .	3	–	1	–	–	3	–	1	–	–
Peabody, . .	578	107	164	1	–	885	201	298	1	–
Pelham, . . .	3	–	–	–	–	3	–	–	–	–
Pembroke, . .	–	–	–	–	–	–	–	–	–	–
Pepperell, . .	32	–	5	–	–	34	–	5	–	–
Peru, . . .	7	–	–	–	–	8	–	–	–	–
Petersham, . .	–	–	5	–	–	–	–	5	–	–
Phillipston, . .	2	–	–	–	–	2	–	–	–	–
Pittsfield, . .	1,023	49	68	3	12	2,398	126	203	3	12
Plainfield, . .	–	–	1	–	–	–	–	1	–	–
Plainville, . .	17	–	37	–	–	20	–	42	–	–
Plymouth, . .	343	64	144	–	36	427	74	188	–	36
Plympton, . .	–	–	–	–	–	–	–	–	–	–
Prescott, . .	–	–	–	–	–	–	–	–	–	–
Princeton, . .	6	–	1	–	–	6	–	1	–	–
Provincetown, .	14	–	10	1	–	16	–	12	1	–
Quincy, . .	757	52	366	4	15	1,645	85	526	4	15
Randolph, . .	111	–	51	–	–	130	–	86	–	–
Raynham, . .	–	–	–	–	–	–	–	–	–	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Reading, . .	206	6	–	1	–	264	6	–	1	–
Rehoboth, . .	8	–	4	–	–	12	–	5	–	–
Revere, . . .	823	24	289	–	1	1,215	37	412	–	1
Richmond, . .	–	–	–	–	–	–	–	–	–	–
Rochester, . .	–	–	–	–	–	–	–	–	–	–
Rockland, . .	148	3	63	39	22	197	3	77	41	23
Rockport, . .	201	5	25	15	6	235	5	40	15	6
Rowe, . . .	–	–	–	–	–	–	–	–	–	–
Rowley, . . .	35	–	13	–	–	43	–	15	–	–
Royalston, . .	11	1	5	–	–	13	1	6	–	–
Russell, . .	18	–	1	–	–	18	–	–	–	1
Rutland, . .	10	–	6	–	–	10	–	7	–	–
Salem, . . .	886	59	528	10	–	2,247	135	683	2	–
Salisbury, . .	48	–	17	–	–	77	–	28	–	–
Sandisfield, . .	–	–	1	–	–	–	–	1	–	–
Sandwich, . .	6	–	2	–	–	7	–	2	–	–
Saugus, . . .	353	2	95	2	–	531	9	133	2	–
Savoy, . . .	2	–	–	–	–	2	–	–	–	–
Scituate, . .	13	–	–	1	–	13	–	–	1	–
Seekonk, . .	13	–	39	–	–	13	–	39	–	–
Sharon, . . .	21	1	5	–	–	26	1	5	–	–
Sheffield, . .	3	–	–	–	–	5	–	–	–	–
Shelburne, . .	9	–	7	–	–	9	–	8	–	–
Sherborn, . .	10	–	7	3	–	14	–	8	3	–
Shirley, . . .	38	4	20	–	–	40	4	21	–	–
Shrewsbury, . .	48	2	18	–	–	74	5	35	–	–
Shutesbury, . .	–	–	–	–	–	–	–	–	–	–
Somerset, . .	102	4	52	3	–	142	6	75	–	–
Somerville, . .	1,396	49	646	–	–	3,631	126	1,095	–	–
South Hadley, .	169	10	83	5	–	268	11	151	5	–
Southampton, .	3	–	2	–	–	3	–	2	–	–
Southborough, .	28	3	1	–	–	37	6	1	–	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

Name of City or Town.	Number of Persons issued Certificates.					Number of Certificates issued.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Southbridge, . .	661	205	439	50	18	746	229	475	59	18
Southwick, . .	1	1	1	–	–	5	2	7	–	–
Spencer, . . .	138	–	96	–	5	159	–	114	–	–
Springfield, . .	3,826	341	1,498	14	–	6,932	625	2,670	17	–
Sterling, . . .	16	1	7	–	–	16	1	8	–	–
Stockbridge, . .	8	–	8	–	–	9	–	10	–	–
Stoneham, . .	198	1	115	–	–	322	2	153	–	–
Stoughton, . .	64	6	159	–	–	99	10	255	–	–
Stow, . . .	5	–	1	–	–	6	–	1	–	–
Sturbridge, . .	48	–	40	–	–	55	–	47	–	–
Sudbury, . .	8	–	–	–	–	8	–	–	1	–
Sunderland, . .	2	–	–	1	–	2	–	–	1	–
Sutton, . . .	140	11	80	2	–	197	13	111	–	–
Swampscott, . .	116	3	23	–	–	174	6	35	–	–
Swansea, . .	48	2	40	1	–	56	4	60	–	–
Taunton, . .	930	220	420	3	–	1,580	370	850	3	–
Templeton, . .	26	6	17	–	9	31	6	22	–	9
Tewksbury, . .	34	–	7	–	–	44	–	10	–	–
Tisbury, . .	3	–	4	–	–	3	–	4	–	–
Tolland, . . .	–	–	–	–	–	–	–	–	–	–
Topsfield, . .	17	–	2	–	–	18	–	2	–	–
Townsend, . .	18	–	11	–	–	20	–	12	–	–
Truro, . . .	2	–	2	–	–	3	–	3	–	–
Tyngsborough, .	30	–	12	–	–	41	–	17	–	–
Tyringham, . .	4	1	5	4	3	5	2	7	7	3
Upton, . . .	47	2	16	–	–	54	2	16	–	–
Uxbridge, . .	–	–	–	–	–	380	33	151	4	–
Wakefield, . .	361	20	132	1	–	456	22	174	1	–
Wales, . . .	–	–	–	–	–	–	–	–	–	–
Walpole, . . .	151	5	26	–	3	133	5	26	–	–
Waltham, . .	1,185	59	292	–	7	1,700	89	480	–	7
Ware, . . .	398	6	174	1	–	497	6	248	1	–

NUMBER OF PERSONS TO WHOM CERTIFICATES WERE ISSUED, ETC. — *Continued.*

NAME OF CITY OR TOWN.	NUMBER OF PERSONS ISSUED CERTIFICATES.					NUMBER OF CERTIFICATES ISSUED.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Wareham, . .	57	5	52	–	–	–	–	–	–	–
Warren, . . .	–	2	93	1	–	–	–	–	–	–
Warwick, . .	1	–	–	–	1	1	–	–	–	1
Washington, . .	2	–	–	–	–	3	–	–	–	–
Watertown, . .	500	30	77	1	6	715	40	99	1	6
Wayland, . .	21	–	–	6	–	21	–	–	6	–
Webster, . .	417	39	343	–	1	666	39	486	–	1
Wellesley, . .	53	2	13	4	–	65	3	15	4	–
Wellfleet, . .	3	–	2	–	–	4	–	3	–	–
Wendell, . .	3	–	1	–	–	3	–	1	–	–
Wenham, . .	11	–	1	–	–	14	–	1	–	–
West Boylston, .	9	2	5	–	–	8	3	5	–	–
West Bridgewater, .	108	3	17	–	–	146	3	17	–	–
West Brookfield, .	18	–	12	3	–	24	–	13	3	–
West Newbury, .	30	–	5	–	–	40	–	7	1	–
West Springfield, .	486	29	183	1	–	851	50	302	1	–
West Stockbridge, .	–	–	–	–	–	–	–	–	–	–
West Tisbury, .	–	–	–	–	–	–	–	–	–	–
Westborough, . .	121	–	64	30	20	162	–	92	40	28
Westfield, . .	490	30	256	32	–	713	46	453	37	–
Westford, . .	60	19	61	–	–	67	19	64	–	–
Westhampton, .	2	–	–	–	–	2	–	–	–	–
Westminster, . .	19	–	7	1	–	21	–	7	1	–
Weston, . . .	15	–	4	–	–	17	–	4	–	–
Westport, . .	41	5	27	–	–	48	6	36	–	–
Westwood, . .	11	–	–	–	–	12	–	–	–	–
Weymouth, . .	206	6	107	1	–	420	8	166	1	–
Whately, . .	–	–	–	–	–	–	–	–	–	–
Whitman, . .	259	–	57	9	–	374	–	76	9	–
Wilbraham, . .	29	16	15	–	–	31	18	18	–	–
Williamsburg, .	68	–	24	–	–	77	–	27	–	–
Williamstown, .	51	1	27	16	–	87	1	35	16	–

Number of Persons to whom Certificates were issued, etc. — *Concluded.*

Name of City or Town.	Number of Persons issued Certificates.					Number of Certificates issued.				
	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.	Educational (Literate).	Educational (Illiterate).	Employment.	Summer Vacation.	Special Part Time.
Wilmington, . .	45	1	4	–	–	48	1	4	–	–
Winchendon, . .	142	9	158	–	–	176	9	182	–	–
Winchester, . .	109	3	53	–	6	140	4	69	–	6
Windsor, . .	–	–	–	–	2	–	–	–	–	2
Winthrop, . .	166	1	31	–	–	192	1	26	–	–
Woburn, . .	351	5	64	–	–	452	8	76	–	–
Worcester, . .	1,895	370	2,144	21	–	11,288	841	5,311	25	–
Worthington, . .	2	–	–	–	–	2	–	–	–	–
Wrentham, . .	23	–	6	–	–	27	–	7	–	–
West Medway, .	–	–	–	–	–	–	–	–	–	–
Yarmouth, . .	–	–	–	–	–	–	–	–	–	–

APPENDIX D.

SPECIAL INVESTIGATIONS.

REPORT ON CUTLERY INDUSTRY.

Inspectors. — Alfred Katz and Eugene J. McCarthy, M.D.

PURPOSE OF THE INVESTIGATION.

The cutlery industry has for many years been considered a particularly hazardous occupation because of the alleged high death rate from tuberculosis and other affections of the lungs among those employed in this industry. In 1907 the Massachusetts Board of Health reported on the cutlery industry as follows: —

> The workmen are not, as a class, long-lived; indeed, the nature of the work is not compatible with longevity, and a person entering upon it in middle life is unlikely to follow it many years. Whatever the age at which the trade is taken up, a man in sound health who has followed it a few years is an acknowledged rarity. A study of the death returns of the city of Northampton, which is one of the centers of this industry, for the past twelve years yields facts which can be interpreted in only one way. During this period tuberculosis is given as the cause of death in no less than $54\frac{5}{10}$ per cent. of those whose occupation is indicated by "grinder" or "polisher," and in $45\frac{4}{10}$ per cent. of those designated generally as "cutlers;" and of the latter, $36\frac{4}{10}$ per cent. died of pneumonia. Taken together, the "grinders," "polishers" and "cutlers" returns show that during this period diseases of the lungs were responsible for $72\frac{73}{100}$ per cent. of their mortality. As is shown in the preliminary report on this industry, the tuberculosis rate of cutlers in Northampton is four times as high as that for the entire adult male population.

In view of the fact that definite statements of the cutlery industry at Northampton had been made by the State Board of Health in 1907, it was thought advisable to study this industry in the same center in 1916. Accordingly, four large cutlery establishments at Northampton and vicinity, employing approximately 600 men, were made the basis of this investigation.

The survey was conducted along the following lines: —

1. A study of each step of the process of manufacture, with special reference to the health hazard involved.
2. A study of the methods employed in diminishing the hazards associated with the process of manufacture.
3. A study of the present mortality rate among cutlery workers at Northampton and vicinity.

Process of Manufacture.

The articles manufactured in the factories inspected include all varieties of table cutlery, chiefly steel. The various steps in the process of manufacturing steel cutlery are essentially as follows: —

I. Steel cut up in desired lengths.
II. "Dropping up" the handle.
III. Heated steel is rolled out in water rolls.
IV. It is hammered into one-edge thinness.
V. Shaped in a press die.
VI. Straightening process by a drop hammer.
VII. Hardened in hot cottonseed oil.
VIII. Tempered to draw hardness down.
IX. Handle grinding.
X. Blade grinding.
XI. Rough necking (kennelling or candling), *i.e.*, tapering edge of blade.
XII. Blade finishing: —
  (*a*) Whitening or soft grinding.
  (*b*) Coarse glazing.
  (*c*) Fine glazing: —
    (1) Marks of the emery wheel are taken off and a nice finish or gloss given to the blade.
XIII. Inspected.
XIV. Etch trade-mark with acid.
XV. Finishing handles (for silver plating if it is done).

Health Hazard.

In general, the hazard to health falls under three headings: —

1. Dusts (mineral and animal).
2. Fumes and gases.
3. Faulty illumination.

1. *Dusts.*

In this industry, as well as in numerous other industries, dust is the great factor in causing ill health and disease. In the cutlery industry the dust is metallic, mineral and organic. These may be classified as follows: —

Metallic: —
  Steel.
  Monel metal (small amount).
  Silver.
Mineral: —
  Alundum: Artificial product manufactured by the Norton Company.
  Carborundum: Artificial product of the electric furnace. Composition, carbon silicide.
  Corundum: Natural product. Composition, aluminum oxide.
  Emery: Natural product. Composition, anhydrous oxide of aluminum, flint, silica and iron. Quality ranging from 100 to FF is used.
  Rouge: Artificial product. Composition, red amorphous powder consisting of ferric oxide (usually prepared by calcining ferrous sulphate).
  Crocus: Similar to rouge; more highly calcined ferrous sulphate.
  Tripoli: Natural product. A siliceous deposit almost wholly of the shell of diatoms occurring in earthy form.
Organic: —
  Wood: —
    Cocobolo.
    Ebony.
    Beech wood.
    Boxwood.
  Animal: —
    Stag.
    Bone.
  Rag: —
    Felt.
    Leather.
    Rubber.

In general, the dust hazard is greatest in three departments, viz.: —

(*a*) Handle sawing and milling.
(*b*) Grinding.
(*c*) Polishing and glazing (including buffing).

(*a*) *Handle Sawing and Milling.* — The machinery used in the manufacture of handles for "tang" cutlery includes saws, turning machines, shapers and drilling machines, all of which may be classed as small woodworking machines. Pearl handles are purchased ready to mount. In the process of turning out the handle from the raw stock a large amount of dust, varying in size from impalpable powder to small shavings, is given off. The dusts may be grouped roughly under the heading of vegetable and animal (organic) dusts, which tend not only to irritate, but because of their hardness injure or lacerate, the mucous membranes. The employers, realizing the dangers resulting from the inhalation of these particles, have introduced dust-exhaust systems consisting of hoods and blowers. The problem of effectively removing the dust is essentially one of enclosing a small cutting edge, or series of cutting edges, and has, on the whole, been well met.

(*b*) *Grinding.* — The grinding of cutlery has been described and classified elsewhere in this report under the general heading of "Wet and Dry Grinding."

In the wet grinding process, which is either the old-fashioned hand or the modern machine or automatic process, the dust hazard is negligible. In the former method the grinders sit astraddle of large emery wheels approximating 5 feet in diameter and 4 inches in width, which run through water. On the machine grinders a stream of water plays continuously over emery wheels approximating 15 inches in diameter, and so prevents the dissemination of emery and steel particles into the atmosphere.

Dry grinding in a cutlery establishment is done on several types of wheels, which vary in size from 10 to 18 inches in diameter, and one-quarter to 4 inches in width of face. The type most generally used on flat work is the wooden wheel with a leather rim, which is "headed" by coating with hot glue and then rolling through pulverized abrasive material. After thorough drying the wheels are ready for use. For bolster and prong grinding, thin solid emery wheels with wooden flanges are provided. For certain grades of work thin wheels of a hard rubber and emery composition are also employed. The wheels revolve *away* from the operator at a speed ranging from 1,800 to 2,200 revolutions per minute. It is evident that at these high speeds the peripheral velocity of the wheels is such as to not only throw the dust with great force from the point of contact of the metal, but to also carry an appreciable quantity around with them. The higher the speed of the wheel the shorter the time required to grind a given piece, which is of material benefit to the piece workers. It has been remarked by one in authority that the employees have a tendency to speed up the wheels, unmindful of the fact that larger quantities of dust are unnecessarily thrown about. In the various grinding processes the work is held in a position on the face of the wheel, which lies in an angle approximately 45 degrees from the vertical. In view of the limited surface actually used for grinding near the top of the wheel, and furthermore, considering the consistent smallness of the articles ground, it appears that the problem of controlling and remedying the dusty conditions is one of ready solution. On the other hand, some difficulty presents itself in the design of an exhaust hood to accommodate wheels varying in diameter from 10 to 18 inches, and in width from one-quarter to 4 inches. Again, a rather extreme, and particularly obnoxious, condition to be met is one which arises during the "racing" or "truing" of the wheel, which consists in pressing a piece of steel against the face of the wheel on a line almost parallel with the hub, and results in the discharge of large quantities of steel and mineral dust almost vertically into the atmosphere of the room. Observation points to but a partially successful solution of the exhaust problem in the grinding room on the part of the manufacturer. Conditions, on the whole, will permit of great improvement.

(*c*) *Polishing and Glazing* (*including Buffing*). — With the exception of knife blades, cutlery ware is polished on hand-wheels. The automatic knife-glazer consists essentially of a wheel which revolves toward the blade, the latter being moved from side to side along the face by means of a carriage. The wheel is of the leather-rimmed, wood type, approximately 24 inches in diameter and 1¼ inches in width. It is "headed up" with a mixture of emery, beeswax and tallow, and touched up with the same mixture during the polishing process. The wheel revolves toward the operator, the blade being held against its surface at a point opposite the hub. The dust, a heavy greasy mixture of emery and wax, is thrown downward under the wheel, although it would appear that a small amount of it is carried around by the wheel when the blade is first brought in contact with the polishing surface. None of the automatic glazing machines was hooded and connected with exhaust, and a casual examination of the atmosphere above the machines shows it to be free from dust. In the absence of an air-sampling apparatus no analyses of the air were made to determine the exact dust-creating capacity of the glazing machines.

In the wet grinding rooms are also found a few hand-glazing wheels, made and headed like those on the automatic glazers. These wheels range from 3 to 5 feet in diameter, and approximately 1¼ inches in width. Smaller glazing wheels are also used. The operator sits astraddle, and somewhat in back, of the wheel, which revolves away from him. The polishing is done on the top of the wheel. No exhaust systems have been installed to convey the heavy, greasy dust from the wheels.

The polishing wheels are similar to the wood variety described under grinding wheels. To obtain certain finishes emery cake (a mixture of fine emery, beeswax and tallow) is applied to the face of the wheel. In some instances rouge, tripoli or crocus is used. Rag and felt covered wooden and steel wheels, "headed up" with an abrasive substance, are also used in the polishing room. The wheel revolves away from the operator, the article to be polished being held in a position near the top of the wheel within an angle approximately 30° from the vertical. As in grinding, the dust is thrown away from the operator and has a tendency to follow the wheel. Deposits were noted on the walls, floor and the operator. The observations relative to the speed of the grinding wheels and the exhaust problem apply to this process of manufacture. An added factor is to be found in some classes of work in the beeswax, tallow and crocus which coat the dust particles, making them somewhat greasy and heavy, thereby decreasing the amount of possible suspended matter in the air. However, the slight "greasing" of the dust generated hardly diminishes its dangerous qualities when inhaled, as it necessarily must be, out of an atmosphere into which it is forcibly thrown and whipped around.

Buffing is practiced on a small scale in the cutlery shops visited, being confined to the finishing of silver-plated ware. The wheels are made up of circular pieces of rag threaded on a spindle, and vary from 3 to 8 inches in diameter. Rouge (ferric oxide) is applied to the wheel, which revolves toward the operator. The work is done on the lower half of the wheel, the rouge dust and lint being thrown downward away from the operator. Owing to the high speed at which the rag wheels are operated and the lightness of the lint, it is readily carried around and churned into the atmosphere. This fact, together with the value of the dust, which is refined for the silver, makes exhaust imperative. The problem here is one of enclosing a small wheel in a hood so designed that the dust which is thrown downward by its own centrifugal force is caught in a branch pipe and so conveyed away from the operator. This type of exhaust system has been carefully developed in the jewelry industry as a means of catching all of the dust for refining, and could be used to advantage in all of the buffing rooms examined.

2. *Fumes and Gases.*

In the forge department the hazard from fumes and gases is a real one. It is often intensified by the use of oil as fuel. The principal poison here is carbon monoxide.

In the department where the hardening process is carried on the use of hot cottonseed oil gives rise to a thick black smoke.

In the hafting department (*i.e.*, where the end of the blade near the handle shank is molded to receive the handle into the product) a compound consisting of 85 per cent. tin, with a small amount of lead, antimony and copper for the better class of goods, is used, while for the cheaper grade of goods a compound consisting of 85 per cent. lead is substituted for the tin.

3. *Faulty Illumination.*

This factor has received little or no attention in this industry. It is the rule in nearly all factories to place the various forms of machinery *parallel* to the line of windows. In many grinding and polishing departments the worker faces the light. This arrangement accounts for the complaint so often heard, viz., that the hoods installed to remove the dust are frequently pushed back by the workers. With hoods set close enough to the polishing, grinding or buffing surface of the wheel to catch the dust, much of the illumination is lost; when the machines are parallel to the windows the worker has practically no light on the part of the wheel upon which he is working. If the hoods of the exhaust are placed higher, so that light may not be obstructed, the dust finds its way into the atmosphere, covering the windows, walls and ceiling, and thereby producing inadequate lighting as well as inadequate dust removal. The obvious remedy is to place the machines at right angles to the line of windows, and thus make possible the use of exhaust hoods close to the work, without interfering with the illumination at the point where the maximum degree of light is required. Much of the complaint against the use of hoods over emery wheels, etc., is due to a disregard of the facts set forth above.

EXISTING CONDITIONS.

(*a*) *Forging.*

In one establishment 40 men were employed stamping knives and forks in the rough. The metal is heated in cold forges and stamped in heavy drop presses. None of these forges was hooded, and much smoke and coal gas were evident in the atmosphere. Ventilation was dependent entirely upon windows and a monitor roof. A metal curtain was in place before the open forge for the protection of the eyes against heat. None of the workmen had been supplied with goggles.

In this same room the hardening process is done by means of hot cottonseed oil. The hood over this bath extended only halfway to the roof, thus discharging into the room a thick black smoke.

In another establishment the forging is done wholly by oil fuel. The room has a monitor roof. There were much smoke and soot present.

In another works each forge was hooded and connected with the chimney. The forge was heated by gas, yet the atmosphere was free from smoke, gas fumes or soot. A second forge in this same establishment was well hooded and connected with an exhaust system. Here all gases, fumes and smoke were removed to the outer air.

(*b*) *Grinding and Polishing.*

There are many varieties of grinding and polishing wheels. The emery surface on the wheel varies with the coarseness of the emery used. This depends upon the grade of the work required. About fifteen kinds of emery are used in the different departments, ranging from one thirty-sixth of an inch mesh to a very fine-powdered substance, called tripoli flour.

There are two distinct processes, known as the "dry" and as the "wet" process. The former is by far the more hazardous. Very few solid emery wheels are used to-day in the cutlery industry. The usual method of grinding and polishing consists of a wooden wheel, to the surface of which is fastened a piece of leather. Hot glue is painted onto the surface of the leather, and as the wheel revolves through a box of emery this surface takes up sufficient emery to guarantee a grinding or polishing surface. The steel surface of the knife is frequently rubbed with mineral wax to prevent rusting. In wet grinding or polishing the steel is wet during the operation, and less emery dust is thrown off. In silver buffing rag wheels with rouge are used. Here iron oxide acts as a polisher. When polishing of silver-blade knives is done by a mixture of pumice and oil, the question becomes one of adequate respirators for the men, rather than a hood-exhaust system.

A very satisfactory method of grinding without a dust hazard consists of a wet-wheel process, called a Hemming grinding machine. A jet of water is playing continuously upon the surface of the wheel, and the surface to be ground is automatically presented to the surface, one man tending six machines. In the older method of wet grinding the worker sits in a saddle and holds the blade to be ground onto a wet stone wheel.

In dry emery polishing and grinding the quantity of dust thrown off increases greatly as the wheels are trued up. This "racing" frequently renders a hood-exhaust system inadequate. It also has a tendency to throw off the dust perpendicularly, and at such an angle as to fall outside the hood. In one grinding room, where eight men were working on emery wheels which were hooded and connected with an exhaust system, the windows, walls, ceiling and men's clothing were covered with dust. A stream of dust was being thrown off in a straight perpendicular line on account of the speeding up of the wheels. In a grinding room in another establishment the ducts were choked with emery dust that had hardened into a solid mass resembling cast iron. In this establishment men were engaged in "rough neck" work on dry grinding emery wheels. In this process the wheel turns towards the worker instead of away from him, as in other processes. The men claim that they can get a better grip on the knife for blade and handle grinding with the wheel turning towards the worker. The hoods, however, were arranged for dust flying upwards, and the result was that no dust was removed from the vicinity of the workers. In this room the wheels were placed at right angles to the line of windows. The illumination on the work was excellent. In a room where German silver handles are soldered onto blades by means of hydrochloric acid and illuminating gas, the gases and fumes were not removed by hoods or exhaust.

In another establishment fifty men were employed candling, swedging and shaping "rough neck" work. Many of the hoods were not connected with exhaust systems. In the saw room, where handles are being made from cocobolo, ebony, beech wood and boxwood, a very efficient blower system took care of the dust in this establishment. In the polishing room there were three rag wheels hooded and well provided with exhaust. All the cement furnaces, drillers and splitters, where the handles are prepared for the shank of knife or fork, were provided with adequate dust removals.

In the pocketknife hafting room and the bolster grinding room in one establishment no hoods have been provided for the emery wheels in this very dusty occupation. In another establishment twenty-nine grinding and polishing jacks are provided with hoods. Only four of this number, however, were adequate and efficient. In two rooms in which the greater part of the grinding and polishing of all steel knives and blades is done forty jacks were hooded and connected with exhausts. None of these exhausts was effective, as the distance between the wheel and the hood was so great that the dust never reached the hoods. In this establishment pumice polishing of knife blades is done by throwing finely powdered pumice mixed with oil against the rapidly revolving wheel, against which the knife blade is pressed. The wheel is protected by a wooden house built over the wheel to prevent the flying of pumice. Nevertheless, the atmosphere, clothes and walls were covered with this powdered pumice. No hoods nor exhausts were provided, as the process is classified as "wet" polishing. In the rouge buffing of silver cutlery, done by rag wheel, a smaller housing is built, and each rag wheel is provided with a sheet metal hood. These wheels rotate at a rate of more than 2,000 revolutions per minute, and rotate towards the operator. A large quantity of lint and rouge collects on the table and about the machinery. Here the hood should have been placed *below* the table so as to catch the dust from the under side of the wheel.

In another establishment the blades are wet, ground and glazed on eight automatic knife glazers. Many of these machines are operated by hand. Very little dust was evident. In the dry grinding and polishing departments, where the handle and bolster grinding and polishing are done by fourteen dry grinding machines and by twenty-one dry polishing machines, the dust hazard was very apparent. Hoods and exhausts had been provided, but the hoods were placed so high upon the wheels that little or no dust reached them. Practically none of the dust reaches the hood when the wheel is speeded.

In another factory, where forty-two polishing and twelve grinding jacks were in operation, all the machinery was hooded and connected with a 32-inch blower. The result was most satisfactory. The hoods were well placed, and the jacks were all placed at right angles to the windows, giving to each worker an unobstructed light from over his left shoulder. It was very noticeable that every hood was in position, whereas in rooms where the jacks were placed parallel to the windows very many hoods had been removed.

In another factory a monitor glass roof was provided. This presented an illuminating efficiency that made possible an arrangement of the hoods that collected nearly all the dust. In the blade-grinding department in this factory there are forty wet grinding machines and ten dry grinding emery wheels. These wheels range in diameter from 14 to 24 inches, and from 1 inch to 4 inches in width. Six of these dry grinding emery wheels are used for "backing" and "kennelling," and four for "rough necking." All the wheels rotate towards the operator, and the material is held on a level with the hub of the wheel. On the wheels for "backing" and "kennelling" the hoods fit closely without interfering with the light, and the exhaust pipe openings are so placed as to carry off quickly and effectively all the dust. An experiment with a larger wheel for "rough necking" has not been successful, as the hood is too far back to catch the dust. This resulted in an accumulation of emery dust which hardened into a cake that obstructed greatly the suction of the exhaust pipe. A 12-inch blower running 1,050 revolutions per minute failed to exhaust the dust on these larger wheels.

Dust-Exhaust Systems.

In studying the effectiveness of the dust-exhaust systems it was originally planned to make a thorough survey of the exhaust blowers, their running speeds, the velocity of the air in the pipes, the layout of the main and branch pipes, the dust arresters, and the design and position of the hoods. The ineffectiveness of the systems, however, became apparent in the early stage of the investigation, and it was concluded to concentrate attention on the design and location of the exhaust hoods. The deposits of dust on the floors, walls and windows, and in some instances on the men, and furthermore its suspension in the air, indicated ineffectiveness in the design of the hoods. Moreover, the abuse of the hoods strengthened this conviction. Accordingly, measurements of the hoods and wheels were taken, giving their relative size and position with reference to one another. Examination of the illustrations, appended elsewhere, will indicate the extreme lines of direction of throw of the dust from the wheels. (The throw of the dust is tangential from the point of contact of the metal, and in the same direction as that in which the wheel rotates.) The range in size of the wheels has been indicated by the smallest and largest wheel used.

In this connection it is well to bear in mind the important fact that the hood should be constructed not only to catch and confine the dust thrown from the wheel in extreme positions of grinding or polishing, but further, that the opening in the hood for the branch exhaust pipe should be so located that dust is thrown toward and into it and immediately conveyed away. The greatest velocity of suction occurring in the branch pipe, it is evident therefore that the closer its position to the wheel the greater will be the quantity of dust exhausted. Where the wheel rotates in a direction away from the operator, and the dust generated is thrown from the top of the wheel, the hood should be constructed around the upper part of the wheel, or the exhaust maintained from above. *Vice versa,* where the wheel revolves toward the operator or downward, the hood should be placed under the wheel at a point to receive the dust as it leaves it; otherwise the velocity of the air is dissipated in the hood and its intensity so decreased as to seriously cut down on its dust-carrying power.

These fundamental principles in hood design have been disregarded to a large extent in the factories investigated. In general, it has been observed that the hoods, and consequently the opening of the exhaust pipe, are located too far back of the wheels, resulting in the escape of large quantities of dust into the air. This is particularly true when the wheels are "raced." In each factory a different type of hood is to be found as suggested by the experience of the person in charge. The various types have been illustrated by diagram.

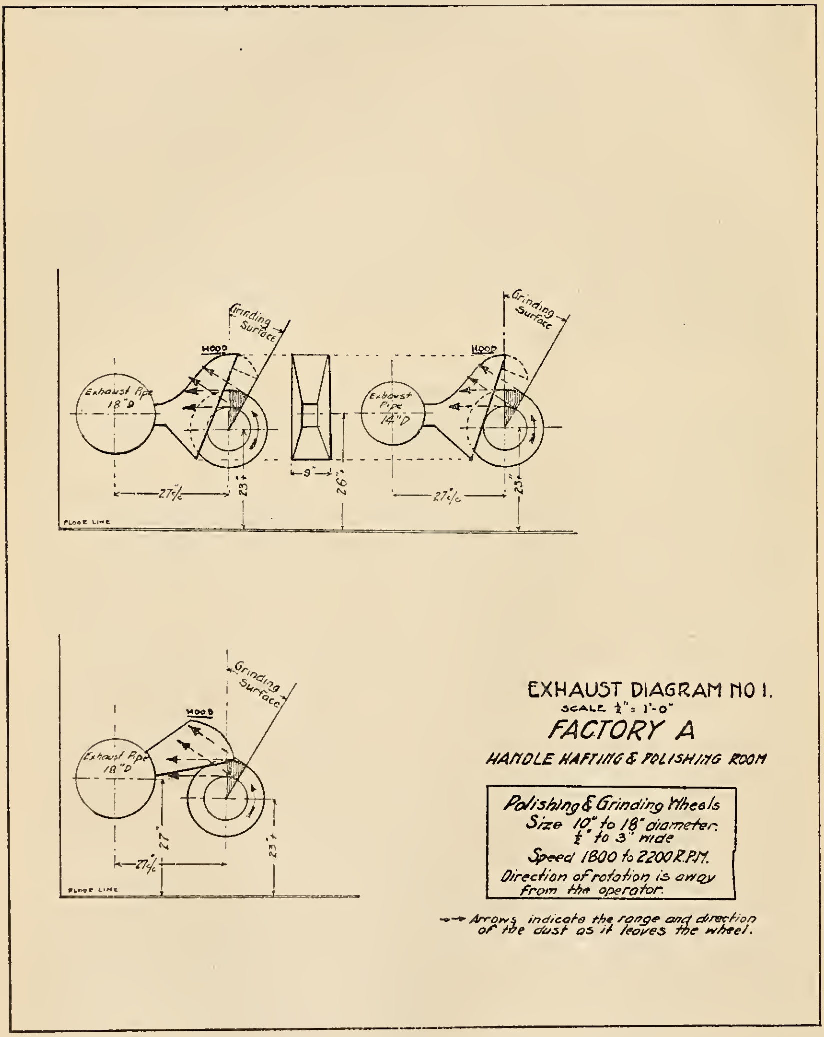
Another factor which must be given consideration in the design and location of the hoods and pipes is that of illumination. With the exception of the handle-finishing room in factory "C," the grinding and polishing jacks are located under and parallel to the windows, the operators facing the light. The installation of an exhaust system immediately becomes a compromise between admitting the greatest amount of daylight and conveying the dust away from the wheel, resulting in partial success from either standpoint. So as not to shut out the light the hoods are placed at some distance from the wheel, usually with the result that the windows and walls become covered with a dark deposit. The light is thereby not only diminished, because of darkened windows and walls, but the dust hazard not alleviated. The interference of the light by the hoods has been the cause of their misuse and discard. The improvement which results when the jacks are placed at right angles to the windows, lighting up the work from the side (aided by overhead lighting from a glass monitor roof), was very evident in factory "C." It allows of a more effective location of the hood and tends to insure its use as placed.

Factory A.

Handle Saw Room. — Machinery, 1 large (cut-up) saw; 5 small circular saws; 1 turning machine.

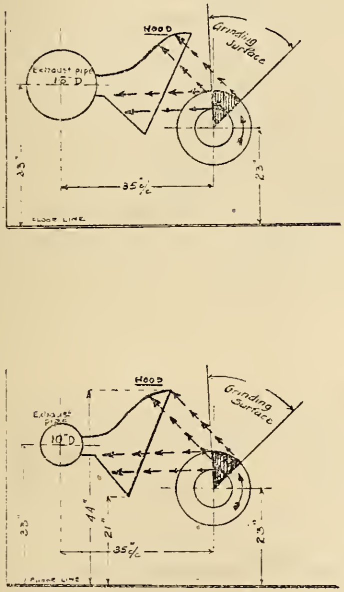
An excellent exhaust system has been installed to take care of the hardwood dusts generated in the cutlery process. The underside of four of the small saws and the large circular saw has been enclosed in a hood, which is connected to an exhaust blower of ample capacity, to keep the room free from dust. The system is maintained in good working condition and is commendable.

Hafting Room. — Seventeen woodworking machines are provided with hoods of various types to effect the confinement of the lighter particles. The hoods are connected through small branch pipes to overhead pipes, which in turn enter a main pipe to the exhaust blower. The velocity of suction is sufficient to convey the lighter, dangerous dusts from the machines, but not great enough to carry off the heavier chips and shavings. The latter, however, are too large and heavy to be considered as injurious. It appears that greater attention has been given to the perfection of the exhaust on these small woodworking machines than to the more important problems which arise in connection with the grinding processes. In this room all handles other than steel are gound and polished. Twenty-nine grinding and polishing jacks are provided with hoods as indicated in Diagram No. 1, and connected with a 22-inch Boston Blower. Of this number but four jacks were found to be properly protected from the dust. The exhaust on eleven jacks to the left of the blower was inefficient, as evidenced by the large amount of wood and bone dust which was thrown outside of the hood. The exhaust on the remaining fourteen jacks was poor.


Grinding Surface
HOOD
Exhaust Pipe 18"D
27"c/c
23"
9"
26"
Exhaust Pipe 14"D
Floor Line
27"
EXHAUST DIAGRAM NO 1.
SCALE ½" = 1'-0"
FACTORY A
HANDLE HAFTING & POLISHING ROOM
Polishing & Grinding Wheels
Size 10" to 18" diameter.
½" to 3" wide
Speed 1800 to 2200 R.P.M.
Direction of rotation is away from the operator.
Arrows indicate the range and direction of the dust as it leaves the wheel.

The hoods are joined by 4 by 5 inch branch pipes to a main pipe varying in diameter from 8 to 18 inches. Two of the 18-inch pipes enter the main 22-inch pipe to the exhaust blower, which conveys the dust to a cyclone arrester.

Grinding and Polishing Rooms. — The greater part of the grinding and polishing (all-steel knives and blades) is done in two adjoining rooms in which two distinct exhaust systems have been installed. Forty jacks have been hooded and connected with the system. The exhaust is ineffective, due chiefly to the excessive distance of the hood from the wheels. This is illustrated in Diagram No. 2.

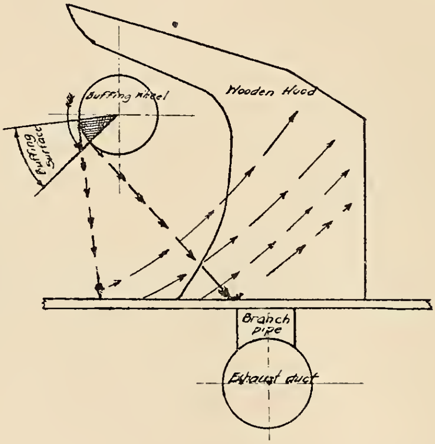


EXHAUST DIAGRAM 2
SCALE ½" = 1'-0"
FACTORY A
KNIFE GLAZING & GRINDING ROOM.
STEEL HANDLE GLAZING & GRINDING ROOM.

Polishing & Grinding Wheels
Size 10" to 18" diameter
½" to 3" wide
Speed 1800 to 2200 R.P.M.
Direction of rotation is away from the operator.

→ → Arrows indicate the range and direction of the dust as it leaves the wheel.

In another department of the factory pumice polishing of knife blades is done. Finely powdered pumice moistened with oil is thrown by hand against the side of a small rapidly revolving wheel, and the knife blade pressed against it in the same operation. The wheel is protected by a wood housing to prevent the pumice from flying about the room. However, the pumice is thrown out through the front of the hood, and is deposited on



SKETCH SHOWING THE DESIGN AND LOCATION OF DUST EXHAUST HOOD
over
ROUGE BUFF WHEEL
FACTORY A

Note- The exhaust pipe has been placed too far back to secure ready exhaust. The hood is so large, that a churning of the dust occurs behind the wheel, retarding its removal.

the clothes and head of the operator. No exhaust system is provided, evidently on the assumption that this polishing may be classed as wet polishing. It appears evident, nevertheless, that an appreciable quantity of the fine pumice must be breathed in by the polisher as it is thrown toward his head.

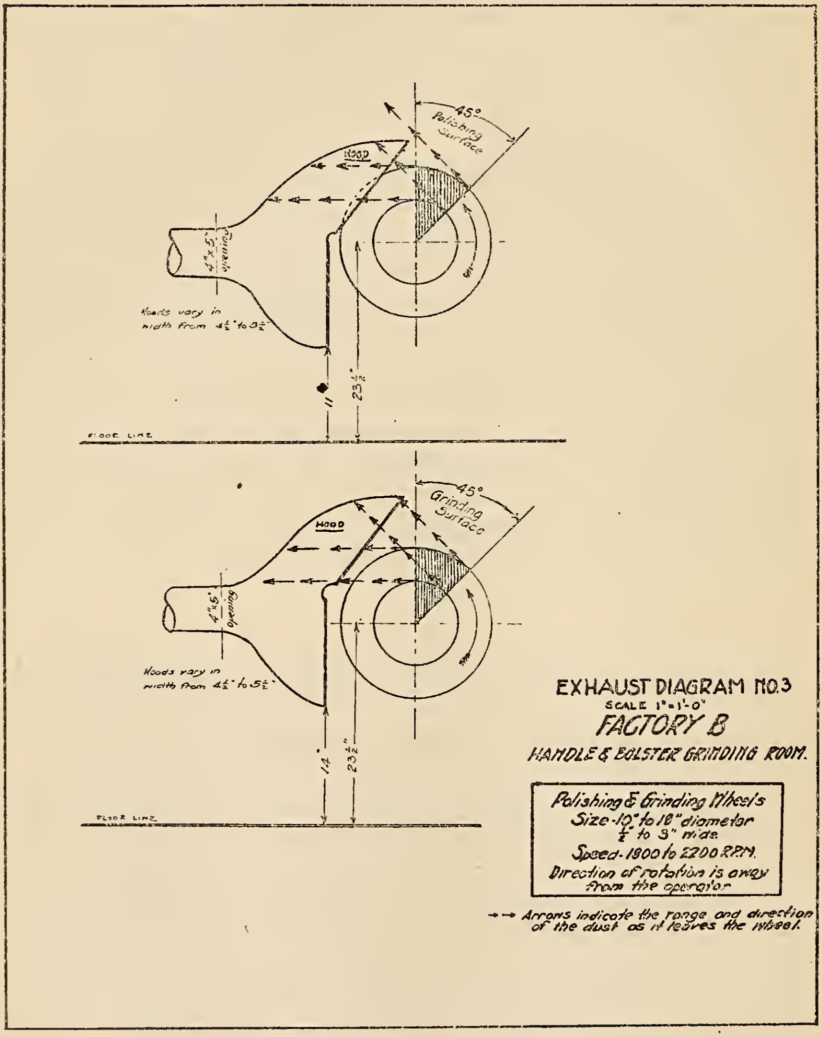
In the same department several tripoli buffing wheels are operated, but have been equipped with well-designed hoods. The exhaust here is good, and the system should be duplicated in the rouge-buffing room.

Rouge (rag wheel) buffing of silver-plated cutlery is conducted in a separate room. Two men were employed on two jacks at the time of the investigation. The jacks have been installed under a wooden housing, and each rag wheel provided with a sheet metal hood. The lathe has been placed above the wheel and attached to a main duct running along the outside of the house to the fan. The rag buff wheels run at a high speed (over 2,000 revolutions per minute) toward the operator, throwing down large quantities of lint and rouge on the buff table. The large accumulation of dust and rouge on the table top and walls of the housing proved the inefficiency of the exhaust system. The hood should be placed below the table so as to catch the dust as it is thrown from the underside of the wheel.

Factory B.

Grinding and Polishing Room. — There are two grinding and polishing rooms in this factory. In the first, the blades are ground automatically on twenty wet grinders and glazed on eight automatic knife glazers. None of the latter machines is provided with dust exhaust. There are also several large wet grinding wheels and knife glazers operated by hand in this room.

Dry grinding and polishing are conducted in the handle and bolster grinding room. There are fourteen dry grinding wheels and twenty-one polishing wheels, hooded as shown on Diagram No. 3, and connected with an 18-inch Boston Blower. From the position of the wheels with reference to the hoods (see diagram) it is evident that the exhaust system is not operated with any degree of efficiency, only a small part of the dust being thrown into the hoods. The hoods over the grinding wheels are placed several inches higher than those over the polishing wheels, and as a result confine the dust somewhat better. A large part of the dust thrown off from the polishing wheels escapes into the air. This is especially true on all the wheels when the surface is trued up. The suspended dust in the atmosphere and the dust deposited on exposed surfaces of the room point to a hazardous condition. It would further appear that the main exhaust pipes and blower are not large enough to adequately take care of the system.



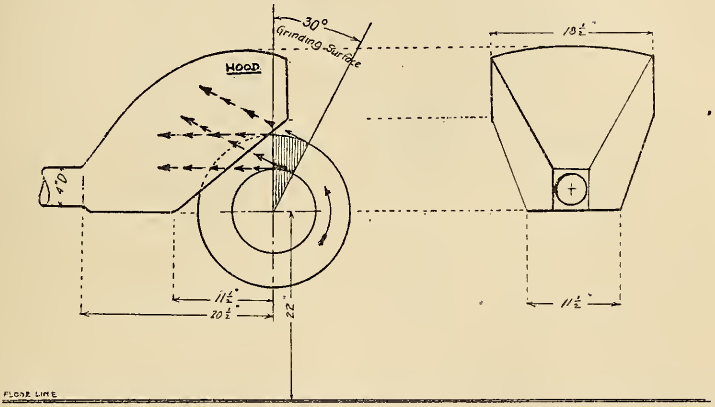
EXHAUST DIAGRAM NO. 3
SCALE 1" = 1'-0"
FACTORY B
HANDLE & BOLSTER GRINDING ROOM.

Polishing & Grinding Wheels
Size - 10" to 18" diameter
½" to 3" wide
Speed - 1800 to 2200 R.P.M.
Direction of rotation is away from the operator

→ → Arrows indicate the range and direction of the dust as it leaves the wheel.

Factory C.

Handle grinding and finishing are conducted in three rooms in this establishment.

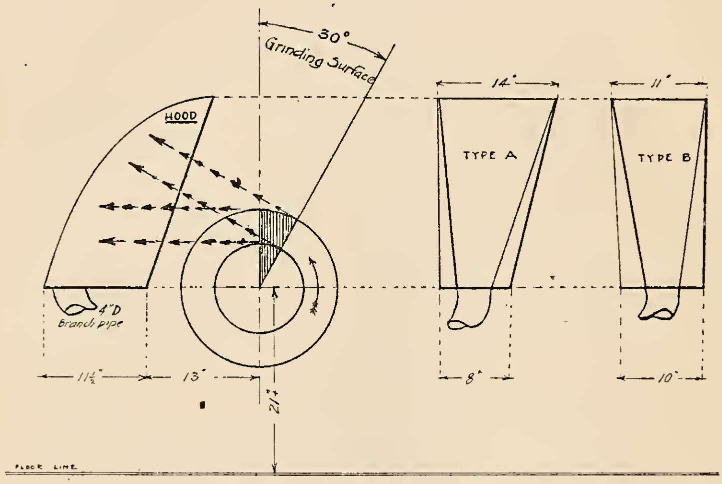


EXHAUST DIAGRAM NO.4
SCALE 1" = 1'-0"
FACTORY C
HANDLE FINISHING ROOM

Polishing & Grinding Wheels
Size - 10" to 18" diameter
½" to 3" wide
Speed - 1800 to 2200 R.P.M.
Direction of rotation is away from the operator.

→ → Arrows indicate the range and direction of the dust as it leaves the wheel.

In the first room the equipment consists of five large wet emery wheels, of which only two are now in operation. A small amount of glazing, or "touching up," is also done in this room. Four large (approximately 4 feet) leather-rimmed wooden wheels and one small wheel of the same type complete the mechanical equipment. The glazing wheels are headed up with emery cake, and throw a small amount of oily dust away from the operator. No dust-exhaust system has been installed.



EXHAUST DIAGRAM NO. 5
SCALE 1" = 1'-0"
FACTORY C
HANDLE GRINDING ROOM

Polishing & Grinding Wheels
Size 10" to 18" diameter
½" to 3" wide
Speed 1800 to 2200 R.P.M.
Direction of rotation is away from the operator.

→→ Arrows indicate the range and direction of the dust as it leaves the wheel.

In the other handle rooms there is an equipment of forty-two polishing and twelve grinding jacks, respectively, which are all hooded and connected into one exhaust system. This system is exhausted by a No. 70 (32-inch) Sturtevant Blower. The two general types of hoods used over the polishing and grinding wheels have been illustrated in Diagrams 4 and 5. Their design and position with reference to the wheel are good. They prove to be the most effective, as regards catching and grinding the dust into the branch pipe, of all those seen in the course of the investigation. Further improvement would be insured, however, were the hoods over the grinding wheels brought several inches nearer to them. The arrangement of the polishing room is especially commendable. The jacks have been placed in three batteries of fourteen jacks each, at right angles to the windows. This position insures unobstructed light from the left or right, which in turn does away with the necessity of shifting or removing the hood to obtain better illumination.

A large glass monitor in the roof has also been installed to better the natural illumination. The improved lighting condition of this room has made possible the design and installation of the hood shown in Diagram No. 4.

In the blade grinding department there are forty wet grinding machines in operation. There are also ten dry grinding wheels of the leather-rimmed wooden wheel type. They range in diameter from 14 to 24 inches, and in width from 1 to 4 inches. Six wheels of this battery are given over to "backing" and "kennelling," and the remaining four to "rough necking." These three operations as performed in this establishment differ in one important respect from those noted elsewhere. The metal surfaces here are ground with the wheel rotating towards the operator, or downwards, the work being held against that part of the face lying on a line with hub. The dust is thrown downwards and can readily be collected and exhausted under the wheel. On the six wheels used for "backing" and "kennelling" the hoods fit snugly without interfering with the light, and the exhaust pipe openings have been located so as to quickly convey away the dust thrown toward them. The "rough necking" wheels are larger in diameter than the others in the same battery, and have not been equipped with proper hoods. It was stated that the larger wheels had been recently installed as an experiment. The small hoods, exhausting from below, were equipped with extension bottoms on the assumption that the dust would be thrown in and be guided into the exhaust pipe. The latter is too far back for this large-sized wheel, and no appreciable velocity of air is evidenced at the outer part of the hood into which the dust is thrown. The emery dust is thrown into the extension, where it accumulates as a hard cake. Dust is also thrown outside of the hood and into the air. The branch pipes enter the main pipe, which tapers from 5 inches at the dead, to 12 inches in diameter at the fan, end from below, which is not considered a good practice. The system is exhausted by means of a 12-inch Buffalo Blower running at a speed of 1050 revolutions per minute. The hoods of the "rough necking" wheels should be enlarged and the exhaust pipe opening brought forward toward the operator.

In the machine-glazing department the arrangement is similar to that existing elsewhere. Ninety-six glazing machines, without exhaust equipment, are in operation in this room. Hand glazing is done to some extent on five small wheels. There are also three dry grinding wheels in operation, the dust from which is thrown into the air, in the absence of an exhaust system. Adequate mechanical exhaust should be installed immediately.

Rouge Rag Buffing. — In this department silver-plated ware is buffed and polished on rag wheels as described in another part of the report. The polishing jacks, eight in number, have been installed on a long polishing table. A wooden housing covers the table over its entire length. No mechanical exhaust appliances have been provided to carry away the rouge and lint dust which is generated in large quantities, the wood housing being depended upon to confine it. As the rag wheel revolves at high speed inside of this wood cover it generates a fan action which whips about the dust particles. Only a small amount of protection is afforded the operators by the wood cover, the wheel revolving toward the operator and throwing its dust downward from the underside. It is essential that properly designed hoods should be installed under the table and connected with an adequate blower.

The conclusions to be drawn from a mechanical survey of the cutlery industry, with reference to the dust hazard, are essentially as follows: —

1. A dust hazard exists in those rooms or departments where dry grinding and polishing are done. Mechanical exhaust has been provided in all of the factories investigated, decreasing the dust hazard to a marked degree, but will permit of great improvement.

2. All dry grinding and polishing wheels should be carefully hooded and connected with an adequate blower system. The hoods should be so designed and placed as to catch the dust as

it is thrown from the wheels, and immediately guide it into the branch pipe opening.

3. Hand holes should be made into the main suction pipes at frequent intervals along their length to permit of frequent cleaning. Systematic cleaning and overhauling of the exhaust systems should be practiced.

4. The operatives should be educated to properly use at all times the dust-elimination devices installed for their protection, and to realize the hazard to their health resulting in their failure to follow these precautions.

5. The education of the employers as to the hazards to which grinders and polishers are subjected, and the necessity of improving the present exhaust installations, is essential.

Mortality from Tuberculosis among Cutlery Workers.

Northampton is one of the chief cutlery centers of Massachusetts, and has a population of approximately 21,650. During the year 1911 there were 4 deaths from tuberculosis among cutlery workers at Northampton. The average age at death was 40.3 years. In this same year there were 22 deaths from tuberculosis among noncutlery workers. Of these, 14 were adult males. The average age of the noncutlery workers at time of death was 39.1 years. The average age of male noncutlery workers who died from tuberculosis in this year was 40.2 years, and for females, 36 years.

In 1912 there was but 1 death from tuberculosis among cutlery workers, while there were 37 deaths from tuberculosis among noncutlery workers, — 23 males and 14 females. The age of the cutlery worker at time of death was 59 years. The average age at death of the noncutlery workers was 40.9 years for adult males and 37.7 for females.

In 1913, 2 cutlery workers died from tuberculosis at an average age of 53 years. There were 23 deaths from tuberculosis among noncutlery workers, — 15 adult males and 8 females. The average age of the adult males of this group of noncutlery workers was 40.5 years, and females, 37.4 years.

In 1914 there was 1 death from tuberculosis among the cutlery workers. His age was 40.3 years. In this year there were 25 deaths from tuberculosis among noncutlery workers, — 15 adult males and 10 females. The average age of the adult males was 33.4 years, and females, 37.2 years.

In 1915 there were 5 deaths from tuberculosis among the cutlery workers and 26 deaths from tuberculosis among noncutlery workers. Of this latter group 11 were adult males. The average age at death of the cutlery workers was 48.2 years, while the average age of the adult male noncutlery workers was 32.72 years, and females, 38.7 years.

At Montague, another large cutlery center, there was 1 death from tuberculosis in 1912 among cutlery workers and 2 deaths (both females) from tuberculosis among noncutlery workers. The cutlery worker died at the age of 40 years.

In 1913 there was 1 death from tuberculosis of a cutlery worker, aged 44 years, and 3 deaths among noncutlery workers at the average ages of 23.5 years for males, and 18 years for females.

In 1914 there was 1 death from tuberculosis of a cutlery worker at the age of 31 years, and 10 deaths from tuberculosis among noncutlery workers. The average age at death of the males in this latter group was 38.7 years, and for females, 36.3 years.

In 1915 there were 2 deaths from tuberculosis among the cutlery workers and 2 deaths from tuberculosis among noncutlery workers. The average age at death was 29.5 years for cutlery workers, and 38 and 35 years for the female and male, respectively, among noncutlery workers.

So far as could be learned there were but 3 deaths among cutlery workers during these years at Northampton and at Montague that were not due to tubercular infection.

SUMMARY.

There were 13 deaths from pulmonary tuberculosis among approximately 300 cutlery workers at Northampton during the years 1911 to 1915, inclusive. During this same period there were 78 deaths of adult males from tuberculosis and of 55 females from tuberculosis, whose occupation was not associated with the cutlery industry, — a total of 133 deaths from tuberculosis among noncutlery workers.

At Montague, with a population of approximately 6,000, there were during the years 1912 to 1915, inclusive, 5 deaths from tuberculosis among 300 cutlery workers, and 17 deaths from tuberculosis among noncutlery workers.

The returns available would seem to indicate —

1. That death from tuberculosis is not so prevalent among cutlery workers as among noncutlery workers (adult males) at these two centers of the cutlery industry.

2. That death among cutlery workers is almost without exception due to tuberculosis.

3. That the age at time of death among cutlery workers who die from tuberculosis is higher than the age at time of death from tuberculosis among noncutlery workers, both male and female.

CONCLUSIONS.

From this study of the cutlery industry it is very evident —

1. That the dust hazard can be reduced to a minimum by hoods properly placed, in accordance with the type of work carried on, on the particular machine creating the dust.

2. That the placing of the machines at right angles to the line of windows would guarantee adequate illumination and remove the necessity for pushing aside the hoods installed on the different machines.

3. That the powdering of the wheel with pumice and oil should be classified as dry grinding and polishing and not wet grinding and polishing; also that adequate exhaust should be installed on these machines.

4. That all gases, fumes and smoke incidental to any process of manufacture can be adequately removed by efficient exhaust system.

5. That the high mortality associated with the cutlery industry is unnecessary, and can be reduced almost to a minimum by suitable attention to dust removal.

6. That the process of polishing, grinding and buffing of small articles is a greater element of dust hazard to the worker than the same work on larger articles, because of the necessity of close proximity of the worker to the grinding, polishing or buffing surface.

7. That the study of the cutlery industry at Northampton shows a marked improvement on the conditions set forth in the report of 1907, dealing with the cutlery industry at this same center.[1]

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[1] Annual Report of Massachusetts Board of Health. 1907.

CONDITIONS IN PATTERN SHOPS.

Inspectors. — Albert W. Buck and Eugene J. McCarthy, M.D.

In consequence of many complaints from those employed in pattern shops the following investigation was conducted.

Forty-two different establishments were visited during this investigation, located as follows: —

Boston,	14
South Boston,	4
East Boston,	1
Roxbury,	1
Dorchester,	1
Charlestown,	1
Hyde Park,	1
Neponset,	2
Readville,	2
Cambridge,	5
Lynn,	1
Indian Orchard,	1
Springfield,	6
Holyoke,	1
Westfield,	1
Total,	42

In each place visited the following conditions were noted: —

1. Number of employees.
2. Different dust-producing machines (number and type).
3. Toilet accommodations.
4. Medical kit equipment.
5. Condition of shop, *i.e.*, whether clean, fair or dirty in appearance.
6. Nature of the dust.
7. Amount of time spent daily by each employee on dust-producing machines and on bench work.
8. Physical appearance of employees.
9. Orders issued to remedy existing conditions.

MACHINES.

The various machines requiring exhaust systems are as follows: —

Sandpaper spindle machines.
Sandpaper disc machines.
Buzz planers.
Circular saws.
Columbia sanders.
Mortice machines.
Tenon machines.
Thickness planers.
Band saws.
Square-headed planers.
Surface planers.
Jig saws.
Wood shapers.
Milwaukee sanders.
Gang saws.
Sandpaper rolls.
Wadkin Universal woodworkers.
Swing cut-off saws.
Lathes.

All the foregoing are capable of being hooded and equipped with exhaust systems, except possibly lathes.

An exhaust system, which would effectually remove the dust produced by the operation of a lathe, and which would not interfere with its operation, would materially reduce the amount of dust escaping into the rooms in many of the establishments visited. The inspectors report that they have not seen a lathe equipped with an exhaust system, and from conversation with many of the workers the practicability of such an equipment is questioned. It is alleged that it would be very difficult to equip a lathe with an exhaust system because of the variance in the length, diameter and shape of the different stock which is turned in pattern making.

This question of properly hooding lathes is a very important one, as it seems to create an exception to the law requiring hooding of all dust-producing machines.

Dust.

The dust derived from wood and sandpaper was very evident in considerable quantities on the sides of the room, ceiling, floor, men's hair and faces, caps, overalls and in the air. The absence of dust was noticeable in a few places equipped with exhaust systems. The wood used in the establishments visited was chiefly pine and mahogany, pine being much more common. Fine, irritating sawdust comes mostly from the band saw, thickness planer and sander. The sand wheel exposes the operator to a sharp mineral dust as well as to wood dust.

Time spent on Machines.

From conversation with employees and owners, the inspectors report that a pattern maker spends 25 per cent. of his time in the operation of different machines and 75 per cent. at his bench. As different men use the various machines at different times, the process of dust producing is practically a continuous one for all employees in the room.

Health.

The inspectors report that many of the workmen mentioned the fact that they were troubled with bronchitis and dry throats. The prevalence of flat chests and round shoulders was quite common.

Mortality of Pattern Makers.

A study of the mortality tables of over 11,000 members in the Pattern Makers Association of North America shows that the average age at death among members of this organization is $43\frac{3}{14}$ years. More than 34.5 per cent. of all deaths was due to tuberculosis. The average age at death of members who die from tuberculosis was $33\frac{5}{6}$ years. Thus the age at death of members dying from tuberculosis was ten years younger than members dying from causes other than tuberculosis. These findings are in accord with the generally accepted belief that pattern making is a very dusty occupation, and one likely to result in tuberculosis of those working at this industry.

Summary of Result of Investigations.

Number of establishments investigated,		42
Number equipped with blower systems,		8
Number not equipped with blower systems,		34
Number with toilets O. K.,		28
Number with toilets not O. K.,		14
Number supplied with medical kit,		16
Number not supplied with medical kit,		26
Number classified as clean,		15
Number classified as fair,		17
Number classified as dirty,		10
Number of Orders No. 19 issued,		14
Number of Orders No. 20 issued,		34
Number of Orders No. 25 issued,		21
Number equipped with hospital accommodations,		3
Physician in attendance,	2	
Nurse in attendance,	1	

THE HAT INDUSTRY.

Inspectors. — Mary K. O'Sullivan and John Roach.

Following a number of complaints relative to working conditions in the hat industry of Massachusetts, a special investigation was made of these conditions with the following results: —

FACTORY A.

This firm is engaged in the manufacture of men's soft fur hats, men's stiff hats and men's silk hats. As a general proposition, the conditions under which employment is carried on in this plant are very fair. The building is a four-story structure with an enclosed stairway protected by fireproof doors controlled by means of a fusible link attachment. Each end of the building has been provided with a fire escape. The fire escapes do not afford adequate protection to workers in this building, owing to the fact that the windows opening onto the fire escape, as well as those directly under the fire escape, are not provided with metal frames, and the glass in the windows is not wireglass. In addition to this, egress to the fire escapes is by means of windows approximately 30 inches above the level of the floor, and in several instances the workbenches are so located as to obstruct the fire escapes.

The first floor of this building is used as a wareroom. The second floor is devoted to silk hat manufacture, the process of which is as follows: —

Four plys of a special cotton fabric are cut in the proper shape, filled with the shellac solution, dried, hardened, shaped and ironed smooth. A powdered varnish is used in the ironing operation. A textile fabric is pasted on the rough form thus constructed, and a friction finish completes the silk hats.

Toilets are suitable and a sink with cold water for washing has been provided.

Twenty-two women are employed trimming hats, and in addition five men are engaged in flanging hats. Toilets are suitable and cold water is supplied for washing. The women are provided with a suitable dressing room.

A few stiff hats are finished on this floor. Thirteen men workers are employed making soft hats. Cold water has been provided for washing. Toilets are in a satisfactory condition.

Gas irons are used in this plant for ironing purposes, but as the workrooms are well ventilated and lighted, it is not likely that this type of iron is harmful in this particular case. Hot and cold water washing facilities should be provided for the sexes.

The absence of harmful processes in this particular plant is due to the fact that this firm purchases hat bodies already formed, and the work consists simply in the finishing of the bodies.

Factory B.

This firm employs approximately 200 men and 80 women, and manufactures men's fur hats and women's wool hats.

Fur Hatting Department.

Fur Blowing. — Four fur blower machines, one mixing machine and one "devil" machine used for breaking up the fur were in operation. None of the machines had dust-control equipment. The blower machines should be equipped with exhaust hoods, and the settling chamber of the mixer and "devil" should have exhaust dust control.

Forming Mill. — Four forming mills are located in this room, which has a high ceiling, is well ventilated, and is of an excellent type for carrying on this work.

Sizing. — Two starting tables, block, brim and tip stretching machines are located in this room. The hot-water tanks on these machines have no steam-control system, and as a consequence a great amount of excessive humidity is exhausted into the air.

Fourteen single sizing machines are located in this department; and while they have been provided with a wooden exhaust duct that is expected to carry off the steam and humidity, the system is not satisfactory.

The hot-water tanks connected with the machines in this room are emptied by pulling a plug in the bottom and allowing the boiling water to run onto the floor. No floor gratings have been provided for the workers to stand on, and as a consequence their feet are constantly wet. A better way of emptying the hot-water tanks is to have them piped directly into the sewer, or, at all events, to have movable floor racks placed in front of the machines on which the men may stand, and thus protect their feet from dampness.

The dressing room used by the workers in this department was in a very dirty condition, besides being too small to use as a lunch room. As a consequence, if lunches are eaten on the premises they must be eaten in the sizing department, which is unsuited for that purpose.

Pouncing. — The exhaust system on the pouncing machines in this room is satisfactory with the exception of the crown pouncing hood, which is expected to carry off dust caused by hand rubbing. This hood has two 2-inch exhaust pipes connected with it. These pipes are of too small a size and are not properly located to accomplish the purpose desired. A hood should be constructed in accordance with the standard recommended in the New Jersey Hatting Bulletin, and a suction sufficient to raise at least 3 inches of water in a pressure gauge should be generated in the exhaust pipe leading to this hood.

Finishing. — The irons used in ironing the brim and crown of the hat are heated with electricity and are being successfully used in this plant. The use of electric-heated irons relieves the worker of the health menace that results from burning large quantities of gas in open burners.

Sandpapering Lathes. — Three sandpapering lathes are being used in this finishing room. These lathes create a great amount of fine dust harmful to the lungs, and should be provided with an efficient system of dust control.

Flanging. — The heating equipment in this room consists of an individual steam plate for each flanging bag. Only a few plates were in use, but the installation appears to be satisfactory.

Trimming. — This is a large room pleasantly situated, windows opening on all sides, and is very satisfactory from the viewpoint of health. The toilet and dressing-room arrangements for the trimmers are satisfactory.

The following improvements are recommended for the fur hatting department: —

First. — A mechanical exhaust dust-control system for fur blowing machines, mixing machine and "devil."

Second. — Vacuum system of cleaning for blower room.

Third. — Provide a standard type buffing hood for crown pouncing.

Fourth. — Provide a mechanical exhaust steam-control system for starting machines, sizing machines, block, brim and tip stretching machines.

Fifth. — Provide movable floor gratings for workers to stand on for starting, sizing, block, brim and tip stretching machines.

Sixth. — Provide direct piping to sewer for hot-water tanks in sizing department.

Seventh. — Provide a clean dressing room large enough for lunches of workers employed in the sizing department.

Eighth. — Provide an exhaust system for pouncing lathes in the finishing room.

Ninth. — Provide a sanitary bubble drinking fountain.

Tenth. — Post a notice in blower room warning workers of danger of mercury poisoning.

Wool Hat Manufacturing Department.

The material that goes into these hats consists of new wool and waste wool. The material is first run through a "picker" machine and is then run through a carding machine and the wool web is wound around a hat form until the desired weight of hat is secured. The process is carried on in this factory in the same manner in which it is carried on in Factory F, a description of which is contained in the report on the F plant.

The Picker. — The picker room is located on the third floor. Two pickers were in operation at the time of the investigation. This is a three-story building, and only one narrow stairway runs from the second to the third story. While only two or three workers are employed on this floor, in case of fire they might suffer injury, as only one wooden stairway affords egress.

Carding. — Fifteen carding machines in this room make considerable dust. The wool bodies are hardened on a steam vibrating machine.

Tipping. — A small amount of wool is added to the tip of a hat to strengthen it. Steam generated by this process is drawn off by an exhaust system. The hats are brought to their proper size in a number of machines called "pushers" and "fulling mills." The hats are then dyed and are next handled by "blocking in" men, who shape the hat on a steam table. This steam table has been provided with an adequate exhaust system. The exhaust system consists of a hooding arrangement, and each hood has a 6-inch exhaust pipe. Thirty-two men are employed at this work.

Finishing Lathes. — After the hat is blocked the finishers place it on a rapidly revolving lathe and smooth the surface with sandpaper. An adequate exhaust system, consisting of a hood and a 5-inch exhaust pipe, cares for the dust.

Buffing. — The hats are buffed down to a fine texture on a sandpaper wheel in the buffing room. The exhaust system in this room is not of a very satisfactory type, owing to the fact that nine 5½-inch pipes are connected to a 12-inch pipe, thus creating an overload. This system should be reconstructed so as to obtain a suction of at least 3 inches of water. The dust made by this operation is fine and penetrating, and should be effectively removed in order to prevent injury to the health of operatives.

Suitable washing arrangements, consisting of hot and cold water, should be provided in all departments, and in addition suitable drinking water should be provided by means of a sanitary bubble drinking fountain.

FACTORY C.

An investigation of working conditions in the fur preparing and felt hatting departments.

Fur Preparing Department.

Opening and Stretching Skins. — The skins are received in bales at the plant, and after they have been dampened they are opened and stretched. The opening and stretching is rather dirty work, but no special hazard accompanies it. Some of the skins are tumbled in a revolving drum to remove "dags" and dirt. This operation gives rise to considerable dust, but as the drums are properly enclosed the dust does not pollute the breathing zone of the worker.

A great quantity of the skins are carded by means of a wire brush to remove the "dags" and dirt. The "carder" goes over the skin (spread out on his knee) with this brush, which occasions a considerable quantity of fine penetrating dust to fill the air. Dust conditions resulting from this process are a problem which confronts every fur preparing plant, but dust-control equipment can be devised that, with proper co-operation on the part of operating firms, will undoubtedly solve it. The coarse hairs are also pulled from the skins in this department by means of a "plucking" machine. The "plucking" machines are equipped with mechanical exhaust which carries off the fine dust and hairs from the work, and deposits them in a box at the end of the room that is installed for this purpose. This box has been screened to prevent any large quantity of dust or hairs escaping.

The floors are cleaned with a broom, and before cleaning wet sawdust is sprinkled on the floors to prevent dust from arising. If floors of this character are properly sprinkled with wet sawdust, the floor-cleaning operation with a broom can be carried on without raising any considerable quantity of dust. But unless this is so the use of a vacuum cleaner is preferred, as this kind of cleaning has proven very satisfactory in a number of fur preparing plants that have such installations.

About 125 persons were employed in opening, stretching, tumbling, pulling and carding skins. No dressing rooms were provided for these workers, a number of whom are females. Washing arrangements are of the most primitive type, consisting only of a cold-water tap inconveniently located and undoubtedly not used by the employees.

The following improvements are recommended for this department: —

First. — That an exhaust system be installed to control dust made by the "carding" process.

Second. — That unless floors are moistened before cleaning, the cleaning should be accomplished by means of a vacuum system.

Third. — That suitable washing arrangements, consisting of hot and cold water, separate for the sexes, be provided.

Fourth. — That suitable dressing room separate for the sexes be provided.

Fifth. — That sanitary bubbling fountain be installed to provide drinking water.

Rounding and Scrapping. — While the skins are being prepared in the numerous processes they must go through, pieces are torn off consisting of tips, cheeks, parts of bellies and cuttings from the edges. These pieces contain valuable fur, and to recover this fur a special process is necessary. These pieces are boiled in a solution of weak sulphuric acid and water, where the animal matter is separated from the fur. The vats where this process is carried on are covered with a mechanical exhaust system that removes the heavy steam vapor before it has a chance to pollute the atmosphere breathed by the workers.

The fur is centrifuged, dried and is blown in blowing machines, where the fleecy fur is separated from dirt and other foreign matter. This blowing operation causes some dust to arise, and the best practice in the trade decides that blowing machines should be equipped with an exhaust hooding arrangement to control the dust. It is true that this dust is not of a poisonous character, as this blown fur has not been "carroted." But it is also true that the room where this work is carried on has a low ceiling, the windows are usually closed, and the ventilation is very bad.

In another part of the plant "roundings," which are "parings" of felt cut from the excess hat brim by the finisher's "rounding jack" when he cuts the brim to its required width, are treated. These "roundings" are chopped into a very thin substance, and are run through a fur blowing machine, where the fine fleecy fur is separated from the heavier dirt by a gravity system. This operation causes great quantities of dust to arise, and as a consequence two of these fur blowing machines have been provided with an exhaust hooding arrangement in accordance with standards recommended in a bulletin on the "Felt Hatting Industry" issued by the New Jersey Department of Labor.

Carroting. — With the carroting process enters the hazard of mercury poisoning, — a menace to health which must be guarded against from now on until the finish of the hat. The carrot is a solution of nitric acid and mercury, commonly 100 pounds of acid to 25 pounds of mercury. Before using, the nitrate of mercury is diluted with water and is applied to the skin by means of a brushing machine. The carroting machine should be covered in so that the fine spray may not get into the atmosphere breathed by the worker. The liquid is highly volatile, and therefore the barrel containing the carrot should not be left uncovered, as is the practice in this plant, and the workers handling the carroted skins should have rubber gloves to protect their hands from poisoning, as poisoning from skin absorption may occur.

Carroting is of two kinds, — white carroting, which results when the skins are dried with nearly natural heat, and yellow carroting, where considerable heat is applied to the skins.

In the white carroting department a very serious menace to health results from the practice of placing carroted skins in open racks in the open room, and permitting heated air from an opening over the boiler room to strike the carroted skins and thus liberate from the skins great quantities of poisonous fumes. This is a most reprehensible practice, and should be discouraged and discontinued without delay, as workers exposed to these fumes must inevitably contract mercurial poisoning. The racks where these skins are placed should be completely enclosed, and an exhaust fan of sufficient capacity should be installed to exhaust the fumes from the enclosure as rapidly as they are liberated. In this connection, if metal fans are used, the metal parts are likely to suffer from corrosion unless they are treated frequently with an acid-resisting solution, which in this case could be an asphaltum paint.

Yellow Carroting. — The dryers in the yellow carroting department are large ovens in which the skins are placed and subjected to a considerable heat. This heat causes the skins to assume a yellow color; hence the term "yellow." The ovens are provided with natural draft for fumes. It must be borne in mind that fumes in this part of the process are highly poisonous, and should under no circumstances be breathed by the workers.

Tumbling Carroted Skins. — After the skins come from the dryers they are thrown into a large tumbling drum, where the dust and dags are removed. They should have an exhaust arrangement to remove the dust made by the process. The dust is, of course, highly poisonous, and if it is swept out with a broom after the skins have been tumbled, the worker doing the cleaning is exposed to the risk of poisoning.

Instead of tumbling, some of the skins are brushed. In this case the dust is thrown by the action of the revolving brushes into a screened box, where it is collected. This arrangement appears to be satisfactory.

Cutting. — After brushing, the pelt is fed in against rapidly rotating knives which cut the skin from the fur, the former dropping down in fine shreds appropriately termed "noodles," and the fur coming out on a traveling apron in the exact position in which it grew on the pelt. This, too, is a dust operation, and the machines should have a dust-control system of a type that experience has shown to be satisfactory. Sixteen cutting machines are located in this department, but only six of them were in use at the time of the investigation. As a consequence the general condition of the room was not at all in accordance with what it might have been had all of the machines been in operation. In addition to this, the weather being warm, windows were open and general conditions of ventilation differed greatly from cold-weather conditions, when windows are tightly closed.

The order requiring mechanical dust control on cutting machines has given rise to a great deal of discussion in fur cutting plants in New York State, as well as in New Jersey. In New Jersey a satisfactory system of mechanical exhaust has been devised for cutting machines that protects the worker from any of the poisonous dust particles that may arise.

The floors of the cutting department are cleaned with a broom. This is a practice that should be discouraged, especially where poisonous materials are used. The statement is usually made that floors are moistened before they are cleaned, but so many floors covered with poisonous materials are cleaned in a dry condition that vacuum cleaning should be insisted upon.

Washing arrangements in this department, as well as in the carroting and tumbling department, consisted simply of a cold-water tap, infrequently used. The operatives are not provided with a dressing room. Neither have they a lunch room in which to eat their midday lunch. It is especially necessary that persons handling the skins while they contain the poisonous carrot should have ample washing arrangements, consisting of hot and cold water, clean dressing room and a clean, separate lunch room where, after properly cleansing their hands, they may eat their midday lunch.

Recommendations for the carroting, brushing, tumbling carroted skins and cutting departments are as follows: —

First. — Rubber gloves and impervious aprons should be provided for the "carroter."

Second. — Ventilating hood with efficient exhaust should be provided for the carroting machine, so that the worker may not breathe any of the fine spray.

Third. — Drying racks in the white carroting department should be enclosed and the enclosure provided with suitable mechanical exhaust for fumes.

Fourth. — A reinspection should be made of yellow carrot drying ovens when they are in use, and in case the fumes are not all drawn away by natural draft, a mechanical exhaust system should be installed.

Fifth. — Drums in which carroted skins are tumbled should be provided with mechanical exhaust to remove the dust generated.

Sixth. — Cutting machines should be provided with a mechanical exhaust dust-control system to take off the dust made by the cutting knives as well as that made by the settling chamber.

Seventh. — A system of vacuum cleaning should be installed in the cutting room and around the tumbling drums and brushing machines.

Eighth. — All cleaning should be done after working hours.

Ninth. — Separate washing facilities for male and female, with hot and cold water, should be provided.

Tenth. — Sanitary drinking water should be provided by means of bubbling fountains.

Eleventh. — Separate lunch rooms outside of the rooms where mercury and carroted furs are handled should be provided.

Twelfth. — Warning notices (such as the following) should be posted in shops, which will call the attention of the worker to the need of personal cleanliness and hygiene: —

Fur cutters are warned of the danger of mercurial poisoning, of which the principal symptoms are soreness of the gums, offensive breath, increase in the amount of spittle and trembling of the fingers.

Workers are warned from the danger arising from the chewing of tobacco and the eating of food with unwashed hands.

Mercury has a tendency to destroy the teeth, and this can be avoided best by the use of a tooth brush once every day.

Felt Hat Manufacture.

Fur Mixing and Blowing. — When the fur arrives at this point in its journey through the plant it is thrown into a mixing machine; for each grade, weight and color of hat requires a different mixture of various kinds of fur. As many as six varieties may be necessary for satisfactory results.

This mixing machine is enclosed and has a picker shaft running through it which is provided with coarse teeth 2 feet long. This picker roll rends and mixes the fur, and forces it into a large settling chamber which has a screen top, through which the air generated by the process is blown. Some of the dust escapes through this screen, and this screened top should be provided with a mechanical exhaust hooding that will prevent the dust from escaping into the workroom. Two of these mixing machines were in operation at the time of the investigation, and considerable quantities of poisonous dust were escaping into the workroom.

Cut Fur Blowing Machines. — After the fur has been mixed it is then run through a blowing machine which is usually a 6-chamber machine having a wire mesh screen covering, each chamber being provided with a long picker roll and a traveling apron. The air currents generated by the first picker roll toss the fleecy fur into the air, separating the dust and hair. The latter falls out of the compartment at the end of the traveling apron, while the former moves into the succeeding compartments to be blown over and over again. This process is one that creates considerable quantities of poisonous dust, which, penetrating the workroom, inevitably produces mercurial poisoning. The best practice in the trade has indicated that this operation can be made safe by providing mechanical exhaust hooding for the fur blowing machines of a type recommended in a technical bulletin on the "Felt Hatting Industry," published by the New Jersey Department of Labor.

Sixteen fur blowing machines are located in this room, but as the plant is not operating to its full capacity only a few of them were being used. When the major part of these machines are in use dust conditions of a most serious character result.

The mechanical dust-control equipment that a number of plants have installed was devised by the superintendent of the cut fur blowing department of one of our very large plants. This man had suffered from mercurial poisoning, and he experimented with the different types of mechanical exhaust until a satisfactory equipment had been reached.

With reference to the cut fur mixing and blowing departments I would recommend —

First. — That all floor cleaning be done by means of a vacuum system.

Second. — That mixing and blowing machines be provided with mechanical exhaust dust control.

Third. — That so far as the work will permit, a vacuum system be used to clean the picker rolls and apron of the blowing machine.

Fourth. — That under no circumstances shall the practice of cleaning out the blowing machines by means of compressed air be allowed.

Fifth. — That suitable washing arrangements, consisting of hot and cold water, be provided.

Sixth. — That a dressing room separate from the blowing room be provided.

Seventh. — That drinking water be provided by means of a sanitary bubble fountain.

Eighth. — That a lunch room separate from the blowing room be provided.

Ninth. — That the same warning notice about the danger arising from mercurial poisoning that is posted in the carroting, cutting and tumbling rooms be posted in the blowing room.

Forming Mills and Starting Machine Department.

After the fur has been blown and freed from dust and other foreign matter it is carried in large boxes to the forming mill room, where the proper quantity of fur required for each hat is weighed on a scale, after which it is deposited by suction on a rapidly revolving cone, thereby forming the hat body. When the proper amount of fur has been deposited on the cone a stream of water is thrown on it, and the delicate hat body is stripped from the cone and taken in charge by a worker known as a "hardener."

In the Marshall Plant the hardeners are women. Owing to their susceptibility to mercurial poisoning, which is recognized by a number of the foreign governments, this work should not be carried on by females. After a long experience in investigating the hatting trade, it indicates that mercurial poisoning among the hardeners is frequent. If legislation is of a satisfactory character it is likely that women will be prohibited from being employed as hardeners.

After a hat body has been hardened it is taken in charge by another group of workers (who are also women) who are called "starters." These women work on tables that are equipped with boiling tanks of water, into which the hat body is dipped. The bodies are rolled in burlap and thrown into a machine that has a number of rapidly revolving rolls, which, by pressing the hat body, start the shrinking process which finally gives it its right size.

Great quantities of steam arise from these boiling tanks of water. An exhaust system has been provided for these tanks that is intended to carry away the steam, but the exhaust system is inefficient and does not accomplish its purpose. Six females are employed on each machine, three on each side of the machine. An exhaust duct consisting of a wooden box is located in the center of the machine, and has an opening along the edge of each boiling water tank. The equipment will permit of sixty females being employed at this work, but at the time of my investigation only a few of them were at work.

In inclement weather, when windows must be closed, it is likely that excess humidity is generated by this process. This could be cared for by a properly arranged exhaust system. No dressing arrangements have been provided for these women, and if lunches are eaten on the premises they must be eaten in the wet room where this work is carried on.

Sizing. — The sizing room where the hats are shrunk to their proper size is located on the ground floor. Owing to poor business conditions only a small number of persons were employed in this department. Consequently it is impossible to correctly judge of conditions as they might exist if the plant were running full-handed and under conditions where it would be impossible to leave windows and doors wide open. As a usual case a sizing room of this kind, during at least six months of the year, is filled with excess humidity that comes from the boiling tanks of water, with which each sizing machine is provided.

An exhaust system has been provided on the first and second sizing machines, but it is not of a very effective type, and is not at all in accordance with the best practice that obtains in other plants.

In addition to the first and second sizing machines I found nine multi-sizing machines. These machines generate great quantities of steam that is not properly carried away by the mechanical exhaust system. In addition to this, the automatic color tanks were not enclosed and provided with an exhaust system.

The male workers who are employed in this department have a small, dirty dressing room inadequately lighted and located in a corner of the ground floor. The females have no dressing room, and lunch rooms have not been provided for either sex.

I would recommend the following improvements for the forming mill, starting and sizing departments: —

First. — That efficient mechanical exhaust system be provided for starting and sizing machines, the multi-sizing machines and automatic color machines.

Second. — That dressing room and lunch room, separate for the sexes, be provided.

Third. — That drinking water be provided by means of sanitary bubbling fountain.

Pouncing. — Five pouncing machines are located on the fourth floor. This is a very dusty process, and the exhaust equipment provided is entirely inadequate. In the first place the exhaust pipes are too small and the air movement generated in the pipes is not strong enough to carry off the dust; the hooding is not designed to properly collect the dust. In the second place the dust that has been collected by the exhaust system is blown into the large box with a screened top, and the exhaust air and dust are released into the workroom. This exhaust equipment should be taken out and a new system in accordance with the best practice should be installed.

The pouncing room equipment on the second floor is also unsatisfactory, and should be reconstructed so as to comply with the best standards. A pouncing operation is carried on in the finishing room on the sixth floor which gives rise to quantities of harmful dust. This dust is generated by brim and crown pouncing machines that have not been provided with dust-control equipment.

Finishing. — This is a large, well-lighted room, and while gas irons and gas shells are used, it is not likely that any serious health exposure occurs. Window ventilation would seem to be adequate in this room. However, three blocking presses located in this room pour out considerable quantities of steam, and this steam might well be cared for by means of an exhaust hood.

Trimming. — This is a large, well-lighted room in which approximately 150 females are employed. A dressing room of too small a size has been provided. Washing arrangements consist of a cold-water tap, and drinking water is provided by means of a common tap. The foreman advised me that each girl supplied herself with a drinking glass.

Flanging. — This is a large, well-lighted room and contains a number of ironing machines and hand irons, all heated with gas. One steam pot is located in this room and has an exhaust hood that is not effective. A number of toilets are located in this room that have no outside ventilation. They are maintained in a very dirty condition, and are entirely improper for use. About 30 females are employed in this room trimming hats who have toilet accommodations furnished on the floor above. No washing arrangements have been made for females.

I would recommend the following for pouncing room, finishing room, trimming department and flanging department: —

First. — All pouncing machines to be equipped with a standard type of mechanical exhaust with effective hooding that removes all the dust.

Second. — All steam pots to be provided with effective hooding that removes the steam.

Third. — Suitable washing arrangements separate for the sexes, consisting of hot and cold water, be provided.

Fourth. — Drinking water to be provided by means of a bubble fountain.

Fifth. — Inside toilets be supplied with mechanical exhaust ventilation and placed in a sanitary condition.

Some years ago an excellent toilet system was installed throughout this plant, and in addition, in each toilet room a number of wash bowls were installed for lavatory purposes. The toilets, however, have been allowed to fall into disrepair. The flush tanks do not work. Joints were leaky, permitting the floors to become saturated. Toilet bowls were not kept in a cleanly condition. The side walls, windows and ceilings were allowed to become very dirty.

I would suggest that the Board insist that the toilet system throughout the plant be placed in a satisfactory condition, and that would necessitate adequate flush for each toilet seat, as well as keeping the toilet room in a clean condition. In addition to this, hot and cold water should be supplied all persons on the premises for lavatory purposes.

In concluding this report I wish to advise that I realize the recommendations incorporated are of a very ambitious scope and will involve a considerable expense. I think the enforcement of these recommendations should be allowed to cover a reasonable period of time, but that the Industrial Board should insist that the more dangerous processes be immediately placed in a safe working condition. The recommendations I have made on dangerous processes in this report have received a number of years of careful consideration in New Jersey, and I have reason to believe that Pennsylvania, New York and Connecticut, where the hatting trade is largely carried on, are also about to take action.

The general conditions in this plant are not worse, but are rather better, than I found in a large number of plants located in the several States mentioned. But this does not minimize the fact that a number of processes, as at present carried on in this plant, constitute a distinct menace to the health of the persons employed.

FACTORY D.

I was informed that the firm employed about 125 persons, and manufactured 100 dozen hats per day.

Fur Mixing and Blowing. — Two fur mixing machines are located in this room. The settling chambers of these machines have a direct air outlet to the outer air, and as a consequence dust generated by the process does not penetrate the working room.

Seven fur blowing machines are located in the room. Only two of them were in use. These machines create a considerable quantity of poisonous dust and should be provided with a proper dust-control system.

Hat Forming. — Six forming mills are located in this room. Only one of these mills was in operation when I was in the plant. I found a young girl, a little over fourteen years of age, weighing fur for these machines. This is not a suitable occupation for a young person, the dust being poisonous and young persons being more susceptible to mercury than the older ones.

The toilet in the mill room is open and ventilated directly into the workroom.

Starting and Sizing Department.

Four starting machines are located in the starting room and thirty-eight single sizing machines are located in the sizing department that is at present in operation. Another sizing department with eighty-eight single sizing machines is not being used. These starting machines and sizing machines should be equipped with mechanical exhaust steam-control system, and in addition, the block, brim and tip-stretching hot-water tanks should have a mechanical exhaust steam-control system. When it is necessary to empty the hot-water tanks the water is allowed to run directly on the floor. These tanks should be connected directly with the sewer, and in addition, floor grating should be provided for sizers, starters, block, brim and tip stretchers to stand on.

This is a very bad type of sizing room, and my judgment is that during the cold months the room is so charged with steam as to constitute a menace to health.

Pouncing. — Three crown pouncing machines and two brim pouncing machines are located in this room. An excellent exhaust system that is satisfactory in every respect provides satisfactory dust control.

Finishing. — Several steam pots are located in this room, and should be provided with suitable hoods. Gas-heated shells are used for ironing. These gas shells help to contaminate the atmosphere of the room, and the ventilation is therefore inadequate. This room has a peaked roof. I would recommend that additional ventilation be provided by the installation of three natural draft ventilators having a diameter of at least 36 inches each. In inclement weather, when windows cannot be opened, the air conditions in this room are evidently bad.

Toilets are dirty and toilet enclosure has an open top.

A cold-water tap furnishes the only washing arrangement. Drinking water is provided by a common cup.

I would recommend the following improvements for this plant: —

First. — A mechanical exhaust dust-control system for fur blowing machines.

Second. — A mechanical exhaust steam-control system for starting machines, sizing machines, block, brim and tip stretchers.

Third. — Hot-water tanks to be connected directly with the sewer.

Fourth. — Movable floor gratings to be provided for workers employed in wet work, such as starting, sizing, block, brim and tip stretching.

Fifth. — Steam removal for steam pots in finishing room.

Sixth. — Additional ventilation by means of natural draft ventilators for finishing room.

Seventh. — Dressing room for starters, sizers, block, brim and tip stretchers; this room to be large enough for the men to eat their lunch in.

Eighth. — Suitable toilets, vestibuled and ventilated to the outer air, to be provided in all departments.

Ninth. — Notice in the fur blowing room warning the workers of the danger of mercury in fur dust.

Tenth. — Sanitary bubbling fountains for drinking water.

Eleventh. — Suitable washing arrangements, consisting of hot and cold water, in each department.

Twelfth. — All cleaning in blower room to be done by means of a vacuum system.

FACTORY E.

This firm is engaged in the manufacture of fur hat bodies. These bodies are sold in the rough, but I understand the hats are expected to be finished in a very short time. The factory building is a two-story frame structure, and is too small to permit of much extension in the business. At present fifteen people are employed.

Fur Blowing and Forming Mill.

The fur blowing and mixing machines are located on the second floor. These machines should be provided with proper dust control, for the fur blowing and mixing operations create harmful dust. The fur used contains nitrate of mercury, and as a consequence the dust is extremely poisonous.

Several pouncing machines were being installed on the second floor, and they should be equipped with standard type of dust control. Seven single sizing machines are located on the first floor. These machines were in operation, and great clouds of steam were arising from the boiling hot-water tank that is connected with each machine. These machines should be equipped with a standard type of steam control.

Women are employed on these sizing machines and so far no provision has been made for a dressing room or lunch room. No toilet accommodations have been provided for these women, who are obliged to go to another building some distance away from the factory. No floor racks have been provided for these women to stand on while working at their sizing machines, and as a consequence their feet are continually wet. Sizing machines should be connected directly with the sewer, so that when it is necessary to empty the hot-water tank the water may run directly into the sewer. At present, when the plug in the hot-water tank is pulled, the water runs over the floor where the sizers are standing.

The toilet for males is not suitably enclosed, and in addition is not properly flushed.

I noticed a young girl about fourteen years of age working in the forming mill room, weighing out fur. By reason of the poisonous character of the fur, which contains nitrate of mercury, this work is entirely unsuited to young persons.

I would make the following recommendations with reference to this plant: —

First. — Provide suitable toilets for both sexes, properly separated, vestibuled and ventilated.

Second. — Provide a lunch room for women workers.

Third. — Provide a dressing room for women workers.

Fourth. — Provide separate washing arrangements, with hot and cold water, for both sexes.

Fifth. — Provide a mechanical exhaust dust-control system for fur mixer, fur blowing machine and pouncing machines.

Sixth. — All cleaning in blower room to be done by vacuum system.

Seventh. — Provide a mechanical exhaust steam-control system for starting machines, sizing machines, block, brim and tip stretchers.

Eighth. — Connect each sizing tank directly with the sewer, so that when it is necessary to pull the plug the water may run directly into the sewer.

Ninth. — Provide movable floor gratings for sizers to stand on, to prevent their feet from getting wet.

Tenth. — Provide sanitary bubbling fountains for drinking water.

Eleventh. — Post a notice in the fur blowing room warning the help of the dangerous character of the fur dust.

While this is a small plant, I think the above recommendations are absolutely necessary in order to insure safe working premises for persons employed therein. It is likely that some objection will be made to connecting sizing machine hot-water tanks directly with the sewer, as the practice, sanctioned by a long period of trade usage, that at present generally prevails is to run the boiling water directly on the floor of the sizing department.

FACTORY F.

This plant until very recently was manufacturing fur hats, but it has entirely discontinued the manufacture of fur hats and is now engaged in manufacturing ladies' wool hats only. However, I will make a brief report on the fur hat department, so that in case this department is reopened you will know what it contains.

The sizing room has sixteen single sizing machines. This room is not equipped with a steam-control system. The hot-water tanks discharge on the open floor, and no movable floor racks have been provided for sizers, starters, block, brim and tip stretchers.

The pouncing room has an exhaust system that was installed several years ago at a considerable expense, and the very serious engineering errors occurring in its construction furnish ample evidence of the urgent necessity of the State's supervising construction and installation of dust-control systems. As an example of its inefficiency I would state that the main duct of the exhaust system has a diameter of 11 inches. Ten 4-inch branch pipes and two 6-inch branch pipes are connected with this system. The main duct, as a consequence, is overloaded to such an extent that were the system operating it would afford but little protection to the pouncers.

If the fur department is started up again I would recommend the following: —

First. — A mechanical exhaust dust-control system for fur blowers, mixers and pouncers.

Second. — A mechanical steam-control system for starters, sizers, block, brim and tip stretchers.

Third. — Movable floor gratings for starters, sizers, brim, block and tip stretchers, so as to prevent their feet getting wet.

Fourth. — Hot-water tanks to be connected with the sewer.

Fifth. — A notice posted in the fur blowing room warning the workers of danger from mercury poisoning.

Sixth. — A dressing room for employees in sizing department and fur blowing room, this room to be large enough for lunches to be eaten in it.

Seventh. — Suitable washing arrangements, consisting of hot and cold water, for all persons employed.

Eighth. — Suitable toilets, ventilated, vestibuled and separate for the sexes.

Ninth. — Sanitary drinking water by means of bubbling fountains.

Tenth. — All cleaning in blower room to be done by means of the vacuum system.

Women's Wool Hats.

This department is engaged in the manufacture of wool hats for women, and seems to be very busy. The material that goes into these hats consists of new wool and waste wool. The raw wool is first run through a picker that tears it apart. It is then run through a carding machine, and a wool web is wound around a hat form until the desired weight is secured. The newly formed hat body is placed under a steam-vibrating plate and hardened.

It is then placed on a form and a little wool added to the tip to strengthen it, after which it is moistened with a weak solution of sulphuric acid "to do the felting process," and thrown into a "filling mill," which by constant friction shrinks the body to its proper size.

The hat body is then dyed with aniline color, steamed, given its proper shape, and is then sandpapered on a finishing lathe. It is then buffed on a buffing wheel, after which it is given a finishing process called "luring."

Several processes of this kind of manufacture give rise to harmful steam and dust. The bench hand that shapes the hat is enveloped intermittently in a steam vapor bath. Fifteen men are employed at this work, and steam-control equipment should be installed to carry off the steam and excessive humidity generated by the process.

Fifteen men are employed on the finishing lathes. An exhaust system has recently been installed on the finishing lathes to carry off the dust made by this process. This installation is partially effective, and again demonstrates the need of State supervision. The exhaust pipes have a diameter of 4 inches, whereas a 5-inch diameter pipe would give much more satisfactory results. The suction on this system is not sufficient to handle the dust effectively.

I would recommend the following: —

First. — That the exhauster on the dust system for the finishing lathes be speeded up so as to generate a suction in the branch pipes sufficient to displace at least 3 inches of water in a pressure gauge, test to be made by making a small hole in the branch pipe farthest from the fan at a point within 12 inches of the table. All branch pipes are to be open and unobstructed when the test is made.

Second. — Dust-control system for "luring" in the bright finishing department, east side of room, does not develop a sufficiently strong suction. This system should be overhauled and an examination made of the collector to see if it is not stopped up, and the fan should operate at a speed to raise at least 2 inches of water in a pressure gauge in each of the branch pipes of this system. At present the suction on the system is not strong enough to handle the dust, although the exhauster is plenty large enough to develop the necessary suction, provided it is operated at a proper speed. The dust made by this process is fine and difficult to control. Constant breathing of it would cause serious injury.

Third. — Toilets are located in the center of the room and ventilated into the room. They should be changed and provided either with outside ventilation or mechanical exhaust ventilation.

Fourth. — Washing accommodations, consisting of hot and cold water, should be provided.

Fifth. — Sanitary drinking water by means of a bubbling fountain should be provided.

Sixth. — An exhaust system should be installed for the removal of steam from the "blocking in" benches. Great quantities of steam are generated by this process which can be controlled by an exhaust system. An exhaust system for this class of work has been installed by Factory B.

Dust conditions prevail to some extent in the carding room of this plant, where six carding machines are in operation; but in view of the fact that the question of providing proper dust-control equipment for carding machines generally has not been considered, I am not making a recommendation for this class of work at this time. However, it should be borne in mind, for at some future time, when a general survey of the textile industry is made in the different States, undoubtedly dust control will be required on carding machines.

SANITARY CONDITIONS OF DEPARTMENT STORE BASEMENTS.

Inspectors. — Albert W. Buck and Alfred Katz.

In view of the constant complaint that working conditions in many of the department store basements are such as to be injurious to the health of employees, a special investigation of the ventilation, heating and air condition in basements in six of the large department stores in the State was carried out in July, 1916.

The following method of investigation was followed in each store: —

1. Area of basement.
2. Cubic contents of air.
3. Number and size of all openings.
4. Number of employees.
5. Average number of occupants (customers).
6. Methods of ventilation.
7. Method of agitating air.
8. System of heating.
9. System of lighting.
10. Temperature readings at various hours.
11. Humidity readings at various hours.
12. Condition of atmosphere as noted or expressed by workers.
13. Temperature and conditions outside.

Standards. — The Illinois law of 1909, stated by Professor Winslow to be "the only real ventilation law in the United States," was used as a standard for ventilation.

United States sling psychrometer was used for wet and dry bulb readings for temperature and humidity.

The direction of the movement of the air was determined by ribbon indicators suspended at various points in the basements.

The size and velocity of fans as given by engineers in charge in the stores were accepted.

No chemical or bacteriological analyses of the air were made.

Visits were made at different hours of the day, and personal observations of air conditions noted, as well as the personal testimony of employees as to the psychological effects of air conditions present at different times of the day and of the year.

A detailed report has been presented of each of the factors indicated in the above schedule.

Any brief summary of this investigation would fail to do justice to the value of the splendid piece of work done by these inspectors.

Many interesting and important facts concerning ventilation in basement stores were gathered and tabulated in a way that should be of great value to this department and to the owners of the establishments investigated.

The investigation was aided in every way possible by the co-operation of the officials of the various places visited. In each case the company, through its administrators, seemed anxious to know the condition of the atmosphere in the basement, and expressed a willingness to take steps to remedy conditions if the investigation showed them to be detrimental to the health or to the comfort of the employees or customers.

In general, the unhygienic conditions noted were high temperature with low relative humidity; "crowd" odors; the odor of merchandise; lack of air currents; lack of freshness in the air; and a general air stagnation.

In many of the basements the temperature ranged from 15° to 25° higher than the outside temperature, and higher than the temperature in other portions of the same building. In these same basements the humidity was from 20 to 30 per cent. less than the humidity in better-ventilated portions of the building.

In several rooms investigated there were no outside windows, and the only method of ventilation was through stairways or elevator wells.

The value of these openings as a means of ventilation is given consideration by the inspectors in their report.

Only one of the establishments visited has a mechanical ventilation system supplying fresh air.

The problem of the ventilation of basements in stores is chiefly one of maintaining the room temperature at a low comfortable point; secondly, of keeping the air in motion; and thirdly, the rapid removal of the heat given off by the bodies of the customers and employees without creating harmful drafts.

The difficulty of keeping the air in motion by mechanical means (fans) in a basement congested by sales counters, merchandise and customers in close proximity to one another is one which must be met not only by horizontal but also by vertical movements of the air. An attempt to circulate the air horizontally through basements by means of electric fans, overhead registers, etc., is apt to result in overhead currents as well as heated rooms stagnant at body level.

In all the basements where efforts have been made to introduce fresh air the system installed supplies air heated near body temperature, and at points high up in the walls rather than air at a low temperature and near the floor. The added heat from the bodies of occupants, as well as from lighting fixtures, soon renders such air unbearable. Cool air introduced near the floor would soon become heated and find its way to the upper part of the basement, where it could rapidly be removed by exhausts placed near the ceiling, an arrangement just the opposite to what now prevails in most of the department store basements.

MINORS IN THE TOBACCO INDUSTRY.

Inspector. — Alfred Katz.

The employment of a large number of minors in the tobacco fields led to this investigation. The following brief description of the kind of work performed by these minors is interesting.

On the majority of the tobacco fields located in the Connecticut valley in Hampshire and Hampden counties tobacco is grown under cloth, and is known to the trade as "shade-grown tobacco." Men are employed for the most part in setting out the tobacco plants and taking care of them in the early stages of growth. Weeding is also done for the most part by grown-ups, and on some farms in the early summer by children. This latter work consists simply of pulling out weeds from between the tobacco plants, either by hand or with the aid of a hoe.

The tobacco is picked beginning about the latter part of July and continuing through the following month. In this part of the State, where shade-grown tobacco predominates, the work is done for the most part by hand; that is, tobacco leaves are stripped from the stalk by hand by minors and children and placed on the ground alongside of the plant. Older boys follow and place the tobacco leaves in baskets, which are then transported to the tobacco sheds or barns. On some of the farms the entire tobacco stick is cut with a special knife. Knife cutting is usually done by older experienced men. Several of the boy pickers who were interviewed stated that the tobacco juice from the green plant stains their fingers a deep brown or black color, and that it smarts and stings the face. Some boys also complained of soreness or smarting of the eyes. It appears that even contact of the leaf with the skin of the face when perspired produces this smarting effect. Other boys who were interviewed did not seem to experience this effect of the tobacco leaf.

The sewing of tobacco is done in barns and sheds by older girls. Approximately thirty pairs of leaves are threaded on a heavy piece of cord by means of a needle. This string of tobacco leaves is attached to both ends of a wooden lath approximately 4 feet long, and suspended from the rafters of the barn to be dried and cured. Here again the fingers of the girls show a marked black stain which is removed only with great difficulty. Some of the girls stated that they feel the effects of the green tobacco juice only on pricking their fingers with a needle. I might add that sewing tobacco on a lath is a modern practice, and is done only on better grades of tobacco. Cheaper grades which are cut by knife in the field are "speared," that is, the entire tobacco stalk is threaded on a thin wood lath and then hung up to dry.

In view of the probability of the tobacco industry becoming, in Massachusetts, an occupation in which women and minors will be employed extensively, the present time seems opportune to set forth certain industrial health factors now recognized as particularly inherent in this industry.[1]

Tobacco cultivation is essentially an agricultural pursuit. It is seasonal in character. The picking of the tobacco in Massachusetts fields begins usually late in July and continues until early in September. The sorting, bundling and packing are done during the November to March period. The cultivating and packing, being an out-of-door occupation, has less elements of danger to health than during the manufacture of the final product. Hence there must be a distinction made in the consideration of health hazards; *i.e.*, whether in the outdoor tobacco growing industry or in the indoor occupation of stripping, assorting and final tobacco manufacture, — namely, cigars, cigarettes, etc.

The following brief account may set forth sufficiently for our purpose the different health hazards in the tobacco industry.

The principal ribs of the tobacco leaf, and those parts of the leaves directly adjoining, show a fine hairiness. These hairs are pointed or are branched out and end in a multicellular gland head. The initial step of manufacture is drying the leaves. In this process an important chemical change in the composition of the leaves takes place, which after the drying is carried along still further artificially by the introduction of a fermentation process, which is allowed to proceed more or less according to whether the tobacco is to be used for cigars, chewing or for smoking.

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[1] Much of the following description of the diseases of the tobaccco worker has been taken from the work of Dr. Stephani from the "Handbuch Der Arbeiter Krankheiten von Dr. Theodor Weyl."

The chemical composition of the tobacco leaf is principally nicotine, nicotianin, volatile oil, protein substance, fat, organic acid, starch flour and pectin substances. The fresh leaf contains 85 to 90 per cent. water; the dry leaf contains from 13 to 30 per cent. In the green tobacco leaf nicotine is generally not free, but is present only in a harmless combination with organic salts. Upon drying a decomposition into ammonia, carbon dioxide and water begins.

The presence of free nicotine is first made evident in the fermentation by the odor. By a very strong fermentation process the nicotine can be completely freed from the previous combination with the organic acids. A dangerous effect is due only to the free nicotine. Cattle frequently eat green tobacco leaves with their fodder without the slightest sign of sickness. In green tobacco leaves nicotine content is from 1.5 to 9 per cent.; in dried leaves, from 1 to 8 per cent.; in fermented tobacco from 0 to 4 per cent. Tobacco loses nicotine constantly during storage.

In the manufacture of snuff tobacco there is very little nicotine, as the leaves are strongly fermented and the future process of manufacture is done with moist tobacco, giving off little or no dust. This process, therefore, offers little or no hazard to health from dust inhalation.

Chewing tobacco process lixiviates the leaves very thoroughly, and brings them into a damp condition for manufacturing. In the preparation of smoking tobacco the leaves and ribs are chopped up very fine with machines. The drying and cleaning are done mechanically (85 per cent.), and the dust is removed by exhausts.

In cigarette manufacturing machines are used almost exclusively to-day, and the tobaccos come in strongly dampened condition for handling. The filling of the cigarettes must be done chiefly by hand.

In cigar making other conditions prevail. Only a few moist leaves are used. The filler consisting of dried leaves, is usually placed in large piles near the worker, who in the handling of the stock, stirs up considerable dust. The binder and the wrapper are used in a moist condition. The half-finished product is dried in the process of manufacture in strongly heated rooms. The formation of the cigars is done by hand almost exclusively.

The health hazards in the tobacco industry, therefore, may be grouped into three classes: (1) poisoning by nicotine; (2) inhalation of tobacco dust; (3) hygiene of workshops.

In the processes investigated in Massachusetts the question resolved itself into (1) the agricultural or farm problem; (2) the storage, assorting and fermentation in the warehouse; (3) the manufacture of the cigars in the factories.

The tobacco plant is grown outdoors and when ripe is harvested, either by cutting the entire stalk or by stripping the green leaves from the stalk. These stalks or stripped leaves are then hung up in the tobacco barns and slowly dried, sometimes with the application of heat, until they are said to be "cured." As they are now too dry to be handled without injury to the leaves, the barns are opened up, doors on all sides being provided for this purpose, during some rainy or damp spell of weather.

If the entire stalks have been cured the leaves are then stripped therefrom. This work is done usually in the open tobacco barns, where ventilation is good and dust a negligible factor.

These stripped leaves are now made up into bundles, which are stored in the fodder barn until winter, when they are opened and the leaves sized and sorted. The sizing consists of separating the leaves into those of different lengths, while sorting means the division of the stock according to quality. The sizing is done by children; the sorting by experienced men. This work is done usually in a small room adjacent to the fodder barn, and the walls are so arranged usually to permit the freest ventilation, especially in winter when the room is heated. The tobacco is still in a damp state, and there is little or no nicotine or volatile oil evolved. There has been more or less tendency lately for dealers to employ minors to assist expert growers in the sorting process.

There are four separate processes, each technically known as "stripping," viz.: stripping the green leaves from the stalks in the fields in harvesting; (2) stripping the cured leaves from the stalks in the tobacco farms; (3) stripping the cases from the sweated tobacco in the warehouses; (4) stripping the midrib from the tobacco leaf in the cigar factories.

It would seem necessary, therefore, to specify which type of "stripping" is prohibited by chapter 831 of the Acts of 1913.

The foregoing description points out quite clearly the particular stages of this industry possessing health hazards to employees, especially minors.

The health hazard in the tobacco industry resolves itself chiefly into two factors: (1) the chemical peculiarities of the substances handled; (2) the special physical nature of the dust.

The chemical constituents of the tobacco leaf that especially influence the human body are nicotine, nicotianin and volatile tobacco oil. The volatile oil of the tobacco leaves produces irritation in the throat; upon internal application it causes giddiness, nausea and tendency to vomit. Nicotianin, even in doses of .03, produces headache, nausea and gas eructation from the stomach; upon direct application to the mucous membranes of the nose it produces violent sneezing.

Experiments show that nicotine approaches hydrocyanic acid in its danger to health and life. Even small doses produce burning in the mouth, irritation in the throat, increased salivary secretion, feeling of warmth, which extends over whole body even to toe and finger tips; then follows violent stimulation, — headache, dizziness, stupor, indistinct seeing and hearing, photophobia, pressure, dryness in pharynx, cold in extremities, flatulency, nausea, vomiting and bowel evacuation. Respiration becomes more frequent and more painful; the pulse, at first quickened, becomes irregular; finally, unconsciousness, trembling of the extremities, shaking of the whole body, laborious and fitful respiration. General exhaustion, sleepiness and mental depression last for three or more days after the poisoning.

The action of nicotine is at first a stimulant to the brain, followed by depression or paralysis of the brain function. The exciting effect upon the spinal cord is shown by tonic and clonic spasms. The functional capacity of the motor centers of the medulla is so completely destroyed that every reflex sensitiveness (strychniatetanus itself) ceases.

Nicotine, even in small doses, quickens the vagus ending and retards the heart movement. Experiments upon animals show also that nicotine has a characteristic effect upon the blood: hæmoglobin is decreased; the number of red blood corpuscles decline; the number of white cells increase; and there is a decided decrease in the alkalimetry of the blood.

The extent to which these various symptoms arise among tobacco workers depends upon two factors: —

1. Does a poisonously working nicotine pass off into the air from dry, nonburning tobacco?

2. Is a harmful amount of nicotine absorbed from the inhaled tobacco dust?

There are as yet no data covering observations of a sufficiently large number of workers in the tobacco industry to warrant more than a general conclusion that these workers are more prone to anæmia, debility and muscular weakness. There is, however, considerable evidence to substantiate the conclusion that persons possessing a peculiar susceptibility to the poisoning develop nerve affections, especially neuritis, paralysis and muscular spasm, when exposed to even small quantities of nicotine. It is an open question how far the various paralyses, spasms, etc., commonly reported among tobacco workers are due to nicotine poisoning, or to what extent they are the result of posture, constant sitting and frequent repetitive action of the same set of muscles in the manipulation of the stock in cigar manufacturing. Many authors pointed out a direct influence of nicotine upon female sexual organs. This relationship is so constant that it has all the appearance of a true industrial oxanæmia.

In all probability the most manifest association of tobacco industry and ill health is seen in diseases of the respiratory organs. Added to the unfavorable conditions of occupations, such as the anæmia of the workers, the sedentary nature of the work, and the close mingling of many persons, there is the added agent of the tobacco atmosphere and dust. The poison content of the tobacco leaves pulverized into fine dust and the volatile and easy resorption of the nicotine have already been pointed out. There remains, however, the consideration of the physical peculiarities that belong to the tobacco dust. The dry tobacco dust possesses the property of swelling and increasing its volume when moistened. This readily clogs the bronchial tubes. It has been demonstrated further that there are very fine cilia, together with barely visible (microscopically) parts of the tobacco leaves, present in very fine dust. There are also, in the finest dust of all, microscopic particles of the leaf and the ribs, together with sharp-cornered particles of wood fiber. These sharp irritating particles all tend to destroy the protective influence of the lining membrane of the bronchial tubes, thus forming chronic forms of catarrh and tuberculosis rather than acute pneumonic processes. Tuberculosis among tobacco workers stands high in the morbidity rate of occupational hazards. How much of the infection is due to occupational agents (nicotine and dust), and how much to droplet infection from the close crowding of workers, is a debatable question.

INVESTIGATION OF WATER USED FOR DRINKING AND HUMIDIFYING PURPOSES IN FALL RIVER MILLS.

Inspector. — William Newsome Eichorn.

Fifty-two corporations were visited, forty-four of which are engaged in the manufacture of cotton goods operating approximately 112 mills, and the following was noted: —

The name of person giving information.
The number of mills operated by the concern.
The number of employees.
Drinking water: —
  Whether the drinking water is cooled before being delivered to the operatives.
  Method of cooling the drinking water.
Humidification: —
  Type of humidification system.
  Source of water used in humidification system.
  Whether waste water from the humidification system is used over again.

Factory No. 1.

This corporation operates two mills, employing 471 males and 427 females.

Drinking Water. — The drinking water is supplied from the city mains by means of faucets in No. 1 mill and bubblers in No. 2 mill. The drinking water is cooled all the year round by means of coils attached to the bubblers and by ice barrels. The company pays for the ice used.

Humidification. — This concern uses the American Moistening Company's humidification system in the No. 2 weave shop, and the Rhode Island Company's humidification system in the No. 1 spinning room, and also makes use of vapor pots.

The water used in the humidification system is taken from the city mains, and the waste water from the humidification systems returns to a tank, where it passes through screens and is again used in the humidification system. This tank is cleaned out every Saturday, and a phenol solution is used in the humidification water, about a pint being introduced every six months.

Factory No. 2.

This corporation operates one mill and employs approximately 300 hands, — 144 males and 133 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets, and a common cup is supplied to the operatives if they desire to use it. The concern also furnishes ice for cooling the drinking water during July, August and September. The containers for the ice do not allow it to come in direct contact with the water, making a sanitary arrangement for cooling the drinking water.

Humidification. — This concern does not use any of the patented methods for obtaining artificial atmospheric conditions in its mill, but relies solely on vapor pots and steam jets, which use steam direct from the boiler which is generated from pond water.

FACTORY NO. 3.

This corporation is engaged in the manufacture of cotton linters, etc., from cotton waste. Two mills are operated by this concern. There are employed at the present time 65 males and 84 females.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets from the city mains. The concern has installed one bubbler on trial, and it intends to install more bubblers at its earliest convenience. No ice is used in this mill to cool the drinking water at any time during the year, the water being allowed to run until it gets cool during the warm months of the year.

Humidification. — This concern uses the Parks system of humidification, and takes the water used in this system from the city mains. As this system is a direct system there is no return, and consequently the water is not used over again in the humidification of these mills.

FACTORY NO. 4.

This corporation employs approximately 206 males and 184 females.

Drinking Water. — Water for drinking purposes is supplied by means of faucets and bubblers from the city mains. In the summer months ice is supplied by the operatives to cool the drinking water. It is the practice in some mills for the operatives to engage an ice man to deliver ice to cool the drinking water. The ice company then provides an ice barrel or other arrangement for the operatives during the time that they buy the ice.

Humidification. — The American Moistening Company's system for humidification is employed by this mill. There are approximately 130 heads in the mill, and the water supply for the system is taken from the city mains. It is customary for this concern to use a phenol solution in its water tanks that are used to supply the humidification system. As the American Moistening Company's system is a return system, all of the water pumped, that is not evaporated into the atmosphere of the room, returns to the tank, where it is screened through wire screens and again used in the humidification system. This tank is cleaned periodically, quite an appreciable amount of decomposed cotton fibers and dirt being removed from it.

Factory No. 5.

This corporation operates two mills, employing approximately 261 males and 251 females at this time.

Drinking Water. — Drinking water is supplied to the operatives by means of faucets and bubblers from the city mains. During the summer months it is the practice for the help to buy ice to cool the drinking water. The night help use ice practically all the time, paying for it themselves.

Humidification. — The American Moistening Company's system of humidification is used by this concern. There are approximately 70 heads throughout the various rooms. The water used for humidification at the present time is obtained from the pond or Quequechan River. A contract had been let to change from pond water to city water on its humidification system. The job, however, has not as yet been started.

The water that is not evaporated into the atmosphere of the rooms returns to the humidification tank, where it is screened and used over again in the system. Periodically a phenol solution is introduced into this water to disinfect it. It is estimated that only 25 per cent. of the water pumped through this humidification system is evaporated into the atmosphere of the room, the remaining 75 per cent. being returned to the tank and used over again.

Factory No. 6.

This corporation occupies three mills, employing 433 males and 404 females.

Drinking Water. — City water is supplied to the operatives by means of faucets. In the summer time ice is used to cool the drinking water, the operatives being obliged to pay the ice company for this service.

Humidification. — This concern does not use any of the patented humidification systems, relying solely upon steam jets and vapor pots which use steam from the boiler.

FACTORY No. 7.

This corporation occupies two mills, employing approximately 302 males and 432 females.

Drinking Water. — Drinking water is supplied to the operatives by means of bubblers and faucets from the city mains. During the summer months, from June to October, an ice barrel is used to cool the water for the operatives. The concern pays the bills for the ice supplied.

Humidification. — The American Moistening Company's system and the Comins system of humidification are used in these mills. There are approximately 178 heads in the rooms, which are supplied from a tank containing both city and spring water, the spring water being derived from a small spring underneath the mill and conveyed to the tank. When there is not enough spring water available the city water is used. The water that returns from the humidification system to the tank is used over again. The humidification tank is said to be washed and thoroughly cleaned out once a week.

FACTORY No. 8.

There are two mills in this concern, employing approximately 308 males and 207 females.

Drinking Water. — Drinking water is supplied to the operatives by means of faucets from the city mains. A bubbler had been installed as a try-out, but was removed, due to abuse by the operatives. During the summer months of July and August the concern pays for ice for cooling the drinking water supplied to the operatives. The concern also supplies a sanitary arrangement for cooling this water, so that the ice does not come in direct contact with the water, being in a separate container.

Humidification. — The Cramer system of humidification is used to obtain the desired atmospheric conditions in these mills. There are approximately 300 heads in the various rooms, and these heads are supplied from a Cramer tank with city water.

FACTORY NO. 9.

This corporation occupies two mills, employing approximately 300 operatives, 158 males and 152 females.

Drinking Water. — Drinking water is supplied to the operatives by means of faucets from the artesian well. This well is approximately 150 feet deep, yielding about 70 gallons a minute. This water is used to supply the drinking and washing water as well as water-closets.

Humidification. — The American Moistening Company's system of humidification is used in the weave shop. In the spinning rooms steam is used from vapor pots. The water for the humidification system is supplied by the artesian well. The waste water from the system returns to the humidification tank and is used over again after being screened. If there is not sufficient humidification water available city water is used. The humidification tank is cleaned out once a week.

FACTORY NO. 10.

This corporation employs 173 males and 210 females.

Drinking Water. — Drinking water is supplied from the city mains by means of faucets. During the summer months, from June to September, ice barrels are furnished the operatives to cool their drinking water. The ice used is paid for by the concern.

Humidification. — This concern uses the American Moistening Company's system of humidification. There are approximately 90 heads in the mill, which are supplied with pond water otherwise called Quequechan River water. I learned on my visit to this mill that it is the intention of the directors to install a tank and to use city water for a time until they decide definitely whether they wish to continue to use city water or to attempt to gain an artesian well supply.

FACTORY NO. 11.

This corporation operates two mills, employing approximately 475 males and 425 females.

Drinking Water. — City water is supplied by means of faucets and bubblers to the operatives for drinking purposes. During the summer months the drinking water is cooled by means of coils, around which ice is placed, so that the drinking water does not come in direct contact with the ice.

Humidification. — This concern uses the Cramer system as well as the American Moistening Company's system of humidification. There are approximately 216 heads located in the various rooms. The water for the humidification system at present is obtained from the Quequechan River, but I was informed that the artesian wells that this concern has been driving have been successful, and it has now obtained two wells, one delivering approximately 50 cubic feet a minute and the other 110 cubic feet a minute. It is the intention of this corporation to connect up its system with this artesian well water just as soon as possible.

Factory No. 12.

This mill employs approximately 197 males and 147 females.

Drinking Water. — Drinking water is supplied the operatives by means of faucets from an artesian well located on the premises. This well is approximately 205 feet deep, and delivers approximately 120 gallons per minute. There is no necessity for cooling this water during the summer months, as it is quite cool enough, being delivered to the operatives from the well.

Humidification. — This concern uses the American Moistening Company's system of humidification, having approximately 60 heads in its various rooms which use city water. The return water from the humidification system is led back to the humidification tank, from which it is used over again in the system. This humidification tank is said to be washed out once a week.

Factory No. 13.

This corporation operates five mills, employing at the present time about 1,130 operatives.

Drinking Water. — The drinking water for these operatives is supplied by means of faucets direct from the city mains. During the summer months it is the practice for the help to buy ice to cool their drinking water, the ice being used in ice barrels supplied by the ice company.

Humidification. — The Rhode Island humidifying and ventilation system is used in these mills, having approximately 170 heads. The water for this system is supplied direct from the city mains, and as there is no return on this system it is not used over again.

Factory No. 14.

This corporation operates two mills, employing at the present time 400 employees.

Drinking Water. — The drinking water for these employees is supplied them by means of faucets and bubblers direct from the city mains. At no time during the year is any attempt made to cool this water by means of ice.

Humidification. — This concern does not use any of the patented types of humidification, but relies solely on steam jets. Long perforated pipes run the length of the rooms, and steam is allowed to escape through these perforations when humidification is desired. The steam is supplied from the boilers, which use pond water.

Factory No. 15.

This corporation operates seven mills, employing 1,763 males and 1,629 females.

Drinking Water. — City water is supplied to the operatives by means of faucets for drinking purposes, and the concern pays for the ice used in the water barrels during the whole year to cool the drinking water for the operatives.

Humidification. — This concern uses the Parks system in its No. 7, 1 and 2 mills, the Hygrosso system in the No. 7 spinning department, and the No. 1, 2, 3, 4, 5 and 6 mills, and also uses the Bell system in some of its rooms. All of these systems are direct systems, using city water, so that no water is returned to any tank and used over again.

Factory No. 16.

This corporation operates two mills, employing approximately 337 males and 406 females.

Drinking Water. — The drinking water for the operatives is furnished by means of faucets from the city mains. In the summer time it is the practice for the operatives to buy their own ice to cool their drinking water. It may be of interest to note that the washing facilities provided in the No. 1 mill use pond water, there being two faucets in the sink; these faucets, however, are not labeled.

Humidification. — In No. 1 mill of this corporation the Garland humidification system is used. In the No. 2 mill the American Moistening Company's system of humidification is used. In the case of the American Moistening Company's system the unused humidification water returns to a tank, from which tank it is used over again.

FACTORY No. 17.

This corporation operates two mills, employing approximately 725 operatives.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets, the water being taken directly from the city mains. During the summer months the drinking water is cooled by means of ice barrels, the help paying for ice used. City water is used for washing purposes in this mill.

Humidification. — The American Moistening Company's system of humidification is used in department 15. Vapor pots are used in department 16. There are approximately 28 drosophores in department 15, which is supplied with city water. Waste water from the humidification system returns to the tank, from which it is used over again. This tank is said to be cleaned out once every month, or two months at the most.

FACTORY No. 18.

This corporation operates three mills, employing approximately 516 males and 475 females.

Drinking Water. — The drinking water for the operatives of the Granite Mills is supplied them by means of bubblers and faucets from the city mains. During the summer months the water is cooled by means of an ice cooler stand, similar to the orangeade variety commonly seen, which prevents the water from coming in direct contact with the melting ice. The ice used is paid for by the concern. The washing water used by the employees in this mill is taken direct from the city mains or from the tank or pond. This water is condensed water which is pumped through the mill.

Humidification. — In No. 1 mill the William Firth humidification system and the Bell system are used. In the No. 2 mill the Bell system is used, vapor pots being used in the weave room. In the No. 3 mill weave room the American moistening system is used, also the Bell system. In the No. 3 mill there are 35 American heads, and there are also 20 Bell system heads in each mill. In the No. 3 mill city water is used, the American Humidification Company's water being returned to a tank and used over again.

In the case of the Bell and William Firth systems there is no return; consequently water is not used over again. In the No. 2 mill they have the Bell system, and artesian well water is used as well as city water.

FACTORY NO. 19.

This corporation operates two mills, employing in No. 1 mill approximately 150 employees, and in No. 2 mill 388 males and 282 females.

Drinking Water. — The drinking water in both mills is supplied by means of faucets direct from the city mains to the employees. In No. 2 mill bubblers are being tried out. Ice is supplied by the ice company to cool the drinking water during the summer months if the operatives pay for same.

Humidification. — No. 2 mill of this concern is equipped with the American Moistening Company's system of humidification, having approximately 125 heads and using artesian well water for this system. This well water is returned to a tank and used over again in No. 2 mill. In No. 1 mill vapor pots are used, these pots being supplied with steam direct from the boiler.

FACTORY NO. 20.

This corporation operates three mills, employing approximately 820 males and 616 females.

Drinking Water. — The drinking water is supplied direct to the operatives by means of faucets and bubblers from the city mains, and is cooled by means of ice placed around coils leading to faucets or bubblers, which ice is paid for by the concern.

Humidification. — In No. 1 mill the Cramer system and the American moistening system are used. In No. 2 mill the Cramer system alone is used. In No. 3 mill the Carrier moistening system of air humidification is used. The water used in these humidification systems is derived from Watuppa Pond, the intake for this purpose being located in the pond above the mouth of the Quequechan River. It may be stated with regard to this concern that pond water is also supplied to the operatives for washing purposes.

FACTORY NO. 21.

This corporation operates four mills, employing approximately 553 males and 519 females.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets direct from the city mains. During the summer time specially constructed tanks are used to cool the water, with the result that the ice supplied by the concern does not come in direct contact with the water in the cooler operation.

Humidification. — The International and the American Moistening Company's systems of humidification are used by this concern in its mills. In No. 3 mill humidified air is delivered into the room by means of the old Sturtevant system, live steam being injected into the air passageways if desired. The water used in the humidification of these mills is derived from the city supply. The American moistening system waste returns to a tank, where it is used over again. This tank is said to be cleaned out once a week.

Factory No. 22.

This corporation operates two mills, employing approximately 188 males and 245 females.

Drinking Water. — The drinking water supplied to the operatives is obtained direct from the city mains, and is supplied to them by means of bubblers. In the summer time the help of the mill buy ice and make use of ice barrels supplied them by the ice company to cool their drinking water.

Humidification. — The Kelly system of humidification is used by these mills. City water is used entirely in their humidification system, and this water is not used over again.

Factory No. 23.

This corporation operates two mills, employing approximately 464 males and 395 females.

Drinking Water. — The drinking water is supplied to the operatives by this concern by means of faucets, and the water is taken directly from the city mains. Bubblers were installed in this mill, but the employees abused them and caused a great waste of water; consequently they were removed. During the summer months, from May to October, sanitary coolers are used to cool the drinking water of the operatives, the concern supplying the ice.

Humidification. — The American Moistening Company's system of humidification is used in this mill as well as steam pots. The water used in the humidification system is derived from Watuppa Pond. The water that returns from the system is not used over again.

FACTORY NO. 24.

This corporation operates two mills, employing approximately 174 males and 199 females.

Drinking Water. — The drinking water for the operatives is supplied to them by means of taps, the water being taken from the city mains. During the summer months the concern supplies Perfection Coolers, and pays for the ice to cool the drinking water.

Humidification. — The American Moistening Company's system of humidification is used in these mills, the water used being derived from an artesian well located on the premises. The return from this system goes to a tank, where the water is screened, and is again used in the system, fresh water from the artesian well being constantly injected as needed.

FACTORY NO. 25.

This corporation operates one mill employing approximately 115 males and 73 females; also a second mill employing approximately 62 males and 14 females.

Drinking Water. — In both of these mills the water for drinking purposes is supplied to the operatives from the city mains. In No. 1 mill faucets are used, and the water is cooled during the summer months by means of a sanitary cooler, the help paying for the ice. In No. 2 mill there are both faucets and bubblers installed, but the water is not cooled for the operatives' use.

Humidification. — No humidification systems are installed in either of these mills, they being engaged in the manufacture of cotton waste.

FACTORY NO. 26.

This corporation operates one mill, employing approximately 176 males and 219 females.

Drinking Water. — The drinking water for the operatives is supplied to them by means of faucets direct from the city mains. During the summer months ice is used to cool the drinking water in the weave, spinning and spooling room, the help, however, being obliged to pay for the ice used.

Humidification. — The American Moistening Company's system of humidification, as well as steam pots, is used in this mill. City water is used in the American Moistening Company's system. The waste from this system is returned to a tank, where it is screened and again used, water being added from the city mains as often as necessary.

FACTORY NO. 27.

This corporation operates three mills, employing approximately 522 males and 598 females.

Drinking Water. — Drinking water is supplied to the operatives by means of faucets direct from the city mains. During the summer months an ice barrel is used to cool the water, the concern paying for the ice used.

Humidification. — In No. 1 mill of this concern as well as No. 2 mill the Garland and Kelly systems of humidification are used. In No. 3 mill the American Moistening Company's system of humidification is used. The water used in this system is derived from the city mains, and in the case of a system having a return for waste water this water is conveyed to a tank, where it is screened and again used in the humidification system.

FACTORY NO. 28.

This corporation operates one mill, employing approximately 232 males and 263 females.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets and bubblers, the water being derived from the city mains. During the summer months ice is used to cool the drinking water, the operatives being obliged to pay for the ice used. In the weave room a barrel is used for cooling the drinking water, while in the rest of the mill a separate container containing coils around which the ice is packed is used.

Humidification. — The Parks system of humidification is used in the weave room, while the American Moistening Company's system is used in the spinning room of this mill. City water is used entirely in this system, the waste water from the American moistening system returning to the sump of the boiler feed pump being utilized in the boiler, with the result that no water is used over again in these humidification systems.

FACTORY NO. 29.

This corporation operates two mills, employing approximately 257 males and 324 females.

Drinking Water. — The drinking water for the operatives is supplied by means of faucets, the water being taken from the city supply. During the summer months the concern supplies ice and sanitary tanks for the cooling of the drinking water for the operatives.

Humidification. — In No. 1 mill of this concern vapor pots are used for humidification purposes. In the No. 2 mill the American Moistening Company's system of humidification is used as well as steam pots. The water used in the American Moistening Company's system is taken direct from the city supply, and the return from this system is screened and again used for humidification purposes.

Factory No. 30.

This corporation operates one mill, employing approximately 159 males and 98 females.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets from the city mains. This water is not cooled before being used at any time during the year.

Humidification. — The American Moistening Company's system of humidification is used in this mill, the water used being derived from an artesian well located on the premises. This well is approximately 35 feet deep, and the water has never been analyzed. The return water in the American Moistening Company's system is conveyed to a tank, where it is screened and again used in the humidification system.

Factory No. 31.

This corporation operates one mill, employing approximately 208 males and 177 females during the day; at night 60 males are employed.

Drinking Water. — The drinking water supplied to the operatives by this concern is taken direct from the city mains. Faucets and bubblers are used. During the summer months the drinking water is cooled by means of ice in sanitary coolers, the ice being paid for by the concern.

Humidification. — This concern makes use of the American Moistening Company's system of humidification in its mill. The water used in the system is derived from the city mains. The waste is returned to a tank and screened before being used over again in the humidification system. Screens and tanks are said to be cleaned out once a week.

FACTORY No. 32.

This corporation operates five mills, employing approximately 142 males and 521 females.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets direct from the city mains. In all of the mills, with the exception of No. 5, sanitary coils are used to cool the drinking water in the summer months. In No. 5 mill ice-barrel type of cooler is used. The ice is paid for by the concern.

Humidification. — This concern uses the Turbo system of humidification in its mills, with the exception of No. 5 mill, where vapor pots are used. City water is used for humidification purposes, and as there is no return to the system the water is not used over again.

FACTORY No. 33.

This corporation operates two mills, employing approximately 311 males and 301 females.

Drinking Water. — The drinking water is supplied to the operatives from a driven well located on the premises, by means of faucets and bubblers. This water is not cooled before being delivered to the operatives because the temperature of the water at the well is about 55 degrees, while in the mill at the farthest point from the well the temperature is 64 degrees, making it unnecessary to cool this water at any time during the year.

Humidification. — The Cramer system of humidification is used by this concern. The water used in the humidification system is derived from an artesian well located on the premises, and any waste from the system is used over again.

FACTORY No. 34.

This corporation operates three mills, employing approximately 578 males and 624 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets. During the summer months, June to September, this water is cooled for drinking purposes, the operatives paying for the ice used.

Humidification. — No. 1 and No. 2 mill of this concern use the Parks system of humidification. No. 3 mill uses the Carrier system of humidification. City water is used entirely for humidification purposes in these mills.

Factory No. 35.

This corporation operates two mills and a dye house, employing approximately 500 hands.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets. During the summer months ice is supplied by the operatives, to be used in the ice barrels for cooling the drinking water.

Humidification. — This mill uses vapor pots in its spinning mills and a moisture of steam air in its packing room. The Kelly system of humidification is also used. The Kelly system is connected up with city water, while the other humidification systems use live steam direct from the boilers.

Factory No. 36.

This corporation operates one mill consisting of two buildings, and employs approximately 269 males and 223 females.

Drinking Water. — The drinking water for the operatives of this concern is taken direct from the city mains and supplied to them direct by means of faucets and bubblers. During the summer months, June to October, the water is cooled by ice supplied by the concern, this ice being used in ice barrels.

Humidification. — The American Moistening Company's system of humidification is used by this concern. There are approximately 87 heads, which are supplied with water taken from the Quequechan River just below its source at Watuppa Pond. This water is returned to a tank and is not utilized again for humidifying purposes.

Factory No. 37.

This corporation operates one mill, employing approximately 194 males and 238 females.

Drinking Water. — The drinking water is supplied to the employees of this concern from the city mains by means of bubblers. During the summer months the drinking water is cooled by means of a coil attached to the bubblers, the ice being supplied by the operatives if they desire to have the water cooled.

Humidification. — This concern uses the Kelly system of humidification as well as the Turbo system. The Kelly system, which is located in the weave shed, is connected with city water, while the other system uses pond water, which is filtered. None of these systems use the water over again. The pond water referred to in the case of this mill is from a pond known as "Cook Pond," and not from the Watuppa Pond, which is usually meant in this report.

FACTORY NO. 38.

This corporation operates two mills, employing approximately 392 males and 440 females.

Drinking Water. — The drinking water supplied by this mill to the operatives is obtained from the city mains and delivered to them by means of faucets and bubblers. During the summer months ice is bought by the operatives to be used in cooling their drinking water.

Humidification. — No. 1 mill of this concern uses the American Moistening Company's system of humidification, while No. 2 mill uses the Garland system. The water used for humidification purposes is taken directly from the city mains, and the waste from the system is returned to a tank, where it passes through screens and is again used for humidification purposes. These tanks and screens are said to be cleaned out twice a week.

FACTORY NO. 39.

This corporation operates two mills, employing approximately 582 males and 201 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains, and is delivered to them by means of faucets. At no time during the year is the drinking water cooled.

Humidification. — No. 1 mill of this concern uses the American Moistening Company's system of humidification in its carding and spinning departments only. The water used for this purpose is obtained from an artesian well on the premises. This artesian well water was formerly used for drinking purposes, but is not so used at present. The water returned from the system is not used over again.

FACTORY NO. 40.

This corporation operates three mills, employing approximately 173 males and 343 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets. At the present time bubblers are being installed for drinking purposes. During the summer months, June to October, ice barrels are used to cool the drinking water for the employees, the employees being obliged to pay for the ice that is used for this purpose.

Humidification. — The American Moistening Company's system of humidification is used by this concern. The water used is derived from the city mains, the waste from the system being returned to a humidification tank, where it is screened and again used for humidification purposes.

Factory No. 41.

This corporation operates two mills, employing approximately 168 males and 224 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets and bubblers. During the summer months an ice pail is used by this concern to cool the drinking water, the ice being put into the pails with the water, and each operative uses her own glass, presumably. The ice used for this purpose is supplied by the concern.

Humidification. — This concern uses vapor pots for humidification purposes, the steam being derived directly from the boiler, which uses river water to produce this steam.

Factory No. 42.

This corporation operates three mills, employing approximately 333 males and 377 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets and bubblers. During the summer months, from June to October, the mill supplies ice for use in ice barrels to cool the drinking water for the operatives.

Humidification. — The Cramer system of humidification, as well as vapor pots, is used by this concern for obtaining a direct atmospheric condition in its mills. City water only is used for humidification purposes.

Factory No. 43.

This corporation operates three mills, employing 296 males and 290 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets, and most of the operatives furnish their own cups for drinking purposes.

During the summer months, July to September, the concern pays for the ice used in the ice barrels for cooling the water for the operatives.

Humidification. — This concern does not use any of the patented types of humidification systems. It does, however, make use of steam jets and vapor pots occasionally.

Factory No. 44.

This corporation operates one mill, employing approximately 130 males and 161 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets. Bubblers are being installed at the present time to take the place of faucets. There is also a surface well located on the premises which the operatives make use of for drinking purposes if they so desire.

Humidification. — The American Moistening Company's system of humidification is used by this concern. The water used for humidification purposes is taken directly from the city supply. The waste water that returns from the humidification system is screened and again used for humidifying purposes.

MISCELLANEOUS ESTABLISHMENTS.

I have also investigated the following establishments which are not mills, but which employ a great number of people and are located in Fall River.

These concerns, as a rule, do not use any water for humidification purposes, as they do not find it necessary in the course of their business to have an artificial condition of the atmosphere for their process of manufacture.

Factory No. 45.

This concern occupies three buildings and three large storehouses, and employs approximately 185 males and 44 females.

Drinking Water. — The drinking water for these operatives is supplied by means of faucets from the city mains. At no time during the year is the water cooled for drinking purposes.

Factory No. 46.

This concern occupies eight buildings and employs approximately 1,369 males and 212 females.

Drinking Water. — The drinking water for the operatives is supplied by means of faucets, and common cups are also used. The water is not cooled for drinking purposes at any time during the year.

Factory No. 47.

This concern operates one mill, employing 82 males and 37 females.

Drinking Water. — City water is supplied to the operatives for drinking purposes by means of faucets and bubblers. During the summer months ice is supplied by the corporation, to be used in pails to cool the drinking water for the operatives.

Factory No. 48.

This corporation occupies one building, employing 211 males and 4 females.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of taps and bubblers. During the summer months an ice barrel is used, the concern supplying the ice for this purpose.

Factory No. 49.

This corporation operates one mill, employing approximately 76 people.

Drinking Water. — The drinking water is supplied to the operatives from the city mains by means of faucets, each operative providing his own cup. There is no attempt made at any time during the year to cool the water used for drinking purposes.

Factory No. 50.

This corporation employs at the present time approximately 1,500 people.

Drinking Water. — The drinking water is supplied to the operatives by means of faucets and bubblers from the city mains. During the summer months the water is cooled, the ice being supplied by the employees.

Humidification. — In the fur blowing department of this concern steam pots are used at starting-up time in the morning.

This is done to warm up the room as well as to moisten the atmosphere, to secure a certain condition of the fur that has been standing in the machines over night. The steam used is taken direct from the boilers.

Factory No. 51.

This corporation operates one mill, employing approximately 125 employees at the present time.

Drinking Water. — City water is supplied to the operatives by means of faucets and bubblers, for drinking purposes, by this concern. At no time during the year is any attempt made to cool water used for drinking purposes.

Humidification. — This concern has recently installed two drums of the Tillotson system for humidification. The water used in these drums is pond water from the Watuppa Pond, that passes through a rapid sand filter before being used for humidification purposes.

NOTE.

During my investigation of the source of water used for drinking and humidification purposes in the Fall River mills, it has been observed in a great many instances that while city water may be used for drinking purposes, another tap is commonly located at the same sink, supplying a different water for washing purposes (usually pond, river or condenser water). As a general rule, these different taps are not labeled to distinguish one from the other.

If these taps were labeled employees would be better guarded against the possibility of using washing water for drinking purposes, especially so if a different color were used and this made uniform throughout the State.

PUBLICATIONS ISSUED BY THE STATE BOARD OF LABOR AND INDUSTRIES OF MASSACHUSETTS.

Industrial Development Bulletins: —

No. 1. Announcement and Digest of the Foreign Trade Situation.
No. 2. Trade Conditions and Opportunities in South America.
No. 3. The Financial and Commercial Operations involved in Foreign Trade.

Industrial Bulletin: —

No. 4. Licensed Workers in Industrial Home Work in Massachusetts.
No. 5. Suggestions to Employers and Employees for the Protection of Eyes and the Prevention of Accidents.
No. 6. Rules and Regulations suggested for the Prevention of Anthrax.
No. 7. Rules and Regulations governing Compressed Air Work.
No. 8. Rule regarding Use of Salamanders.
No. 9. Safety Rules and Regulations and Machinery Standards.
No. 10. Rules and Regulations relating to Safe and Sanitary Working Conditions in Foundries and the Employment of Women in Core Rooms.
No. 11. Rules and Regulations suggested for Safety in the Manufacture of Benzene Derivatives and Explosives.
No. 12. Rules and Regulations for the Prevention of Accidents in Building Operations.

Manual of the Labor Laws.
Rules and Regulations for Toilets in Industrial Establishments.
List of Articles for Medical and Surgical Chest.
Pamphlet entitled "Some Facts about Dust and your Pay Envelope."
Posters for Wash and Toilet Rooms.
Poster for Prevention of Lead Poisoning.

Time Notices for posting Hours of Labor of Females and Minors.
List of Minors employed between Fourteen and Sixteen Years of Age.
Schedule of One Day's Rest in Seven.

Pamphlets on Industrial Development: —

South America and Massachusetts.
The Labor Exchange of England.
Unemployment — A New Method of gathering Statistics.
The Advisory Council.

Annual Reports: —

First Annual Report, 1913.
Second Annual Report, 1914.
Third Annual Report, 1915.
Fourth Annual Report, 1916.

Copies of these publications free on application to the State Board of Labor and Industries, 1 Beacon Street, Boston, Mass.